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ABSTRACT

Today the auto industry is going through the most radical restructuring it has experienced since its birth. Included in this upheaval is a dramatic reorganization of the workplace, and technology has been both a catalyst and a central part of such change. The issues involved touch every facet of workplace life: job classifications and demarcation lines; seniority rules and transfer rights; teamwork and production standards; health and safety and the work environment; new skills and the content of retraining; the erosion of bargaining units and the degree of supervision; relations among workers and relations between workers, their unions, and management. The study reported in this paper by the Canadian Auto Workers union used a survey, case studies, and roundtables at seven auto industry plants in Canada to define what is happening in the workplace in terms of technological change. Extensive use of quotations from these sources is made throughout the report. The report is composed of six chapters that cover the following issues: (1) the new technology; (2) disappearing jobs; (3) transformation of work; (4) the new management agenda; (5) labor and technological change; and (6) policy implications for labor. Definitions of technical terms are provided. (KC)

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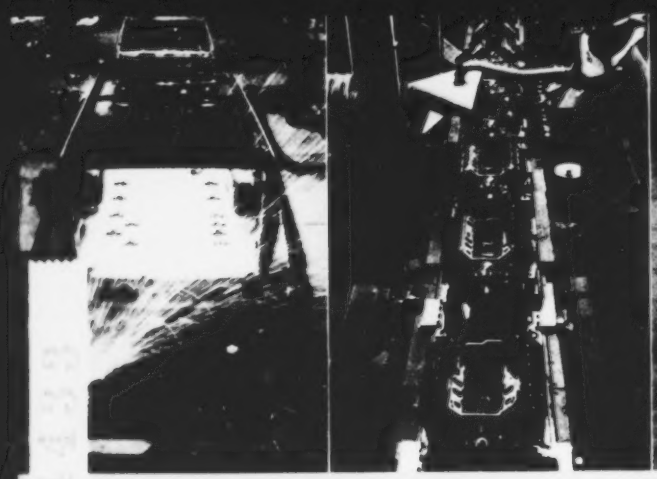

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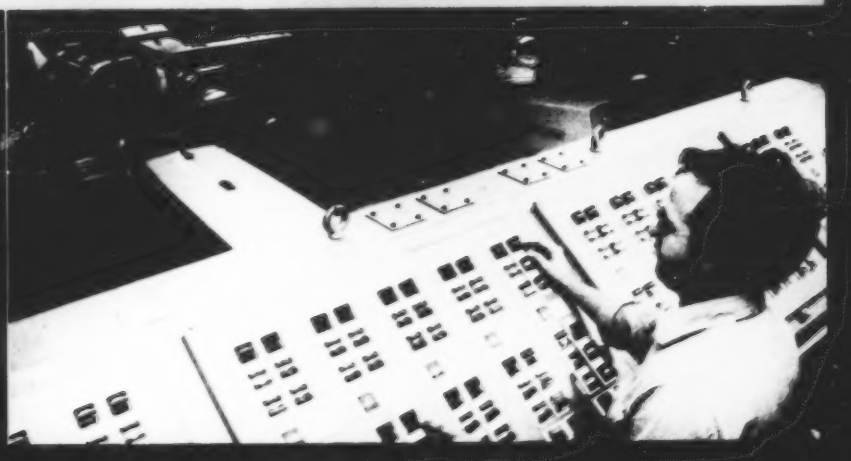

CAW TECHNOLOGY PROJECT

BY
DAVID ROBERTSON
JEFF WAREHAM

FEBRUARY, 1987

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CAW TECHNOLOGY PROJECT

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CAW Technology Project
April 1987

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PREFACE

Workers generally have mixed feelings about new technology. On the one hand it does threaten the loss of some jobs, but on the other the most insecure workers are those whose plants have totally missed out on *any* new technology. New technology does disrupt past practices, but it also lays the basis for rising incomes and benefits.

Whether the outcome of technology is good or bad, many workers feel there is little we can do about it. Whether we like it or not, the new technology is coming, and so, it seems, we should concentrate on sharing in the new wealth created rather than debating its specifics and merits.

From the perspective of jobs, this attitude does make some sense. If we want to maintain or increase the number of jobs, it is clear that a strategy of challenging the new technology won't work. The issue of jobs requires two approaches, both of which accept the role of new technology.

The first emphasis is on the broader environment in which production and new technology take place. If we put policies in place to better plan domestic production to meet social needs and if we regulate trade, any negative effects of technology on jobs can be offset. The second focuses on the new capacity to produce more goods with less labour. Sharing in the new productivity by maintaining income while working fewer hours means either fewer layoffs or more jobs.

But the issue of new technology goes beyond the issue of the number of jobs. Today the auto industry (like many other industries) is going through the most radical restructuring it has experienced since its birth. Included in this upheaval is a dramatic reorganization of the workplace, and technology has been both a catalyst and a central part of such change. The issues involved touch every facet of workplace life: job classifications and demarcation lines; seniority rules and transfer rights; teamwork and production standards; health and safety and the work environment; new skills and the content of retraining; the erosion of bargaining units and the degree of supervision; relations amongst workers and relations between workers, their unions, and management.

If the union is to survive on the shopfloor or in the office, it must clearly remain relevant in addressing such issues. Given the fact that the new technology is so central to shaping the future work environment, we must therefore address the issue of influencing, and exerting a measure of control over, the new technology. Unions that can't address the dominant factors shaping the workplace will fade as a factor in the workplace, with an obvious and serious weakening of the union overall.

Some steps toward union input into technology have been made, but they remain limited. Some corporations have talked about greater worker input, but this remains to be tested and is simply not good enough. We can no longer accept the process of introducing new technology as a "management right". We must place the principal of *negotiating* technological change on the agenda.

Negotiating tech change means that if the corporations can plan its introduction so methodically and so far in advance, they can also give us the contractual right to advance notice. It means we must have a direct input into the growing level of training so that it goes beyond how to adapt to a given technology and includes training to control and modify that technology. It means collective agreements that recognize that since technological change is now so integrally related to *all* working conditions, its implementation must be jointly administered.

Above all, it means that we recognize that technology is not simply a "thing" mysteriously coming from the outside, but a product of human activity that is currently shaped by management priorities, but can also be shaped to address workers' needs.

Some will accuse us of overstepping our role as "workers". But just as paying workers for not working (paid vacations) was once thought of as an absurd proposition, just as paying workers who were no longer employees was once considered outlandish (pensions), just as health and safety issues were — not too long ago — thought of as an inherent cost of having a job, technology can no longer be left to unilateral management decisions, nor loosely reserved for management-dependent "consultations".

The issue, therefore, is not whether technology is good or bad, whether we are for or against it. The issue is, will we share in the wealth it creates, the leisure it makes possible, and can we wrest some control from a management determined to subordinate the new organization of work to the goal of competing for profit.

The CAW Study on Technological Change in the Auto Industry

The purpose of this study was not to formulate specific policy, but to focus our union's attention on this issue and provide workers with a handle on what is happening in the workplace in terms of technological change.

The study was financed by a grant from Labour Canada's Technology Impact Research Fund (TIRF) and completed over the twelve month period beginning in February 1986.The research was carried out by two researchers, David Robertson (Chief Researcher) and Jeff Wareham, who worked under the supervision of our research department and the Technology Committee of the

CAW's Canadian Council.

David and Jeff did not come to this topic from a neutral perspective — their sympathy to working people is clear. But they understood that the contribution we needed was not to get what we wanted to hear, but an honest and clear description of the actual situation confronting us.

Their study addresses the scope and range of the technology that is already in place and its apparent direction; it deals with the issue of job loss and job displacement; it examines the transformation of work taking place and puts this in the broader context of the "new management agenda"; it considers the impact of the new technology on the union; and the researchers conclude with some brief and general opinions about the policy implications of their study.

There will no doubt be some disagreements with some of the analysis. That is to be expected — we're looking at an industry in transition, the pace of change is quite incredible, and it is also uneven between workplaces. Nevertheless, I hope and expect that this study will provide our leadership and membership with some valuable tools, and that it will help deepen and strengthen our insight and resolve in dealing with this absolutely critical issue.

Sam Gindin
Assistant to the President
CAW-Canada
April, 1987

FOREWORD

PROJECT OVERVIEW AND DESCRIPTION

The work of the project, in addition to the usual research activities, proceeded on two major fronts: the Technology Surveys and the Case Studies and Roundtables.

Technology Surveys

Two separate Technology surveys were constructed and distributed. The first was sent to CAW plant chairpersons in the the assembly, captive and independent parts industries; the second was distributed to chairpersons of the CAW office units within the automotive sector.

The surveys were extensive and relied on both fixed-response and open-ended questions. Both surveys were structured along similar lines and both were divided into three sections. The first section requested a detailed inventory of the technology in the plant or office, from the number of robots to the implementation of Statistical Process Control (SPC). In addition this section asked for a description of the workplace, the makeup of the bargaining unit and the role of the local union in the process of technological change. The second part of the survey focused on the effects of technological change. It explored the impact of new technology on job numbers and job content, the organization of work and the pattern of production, and it assessed the effects of new technology on the quality of working life. The third and final section of the survey addressed the issues associated with training and retraining initiatives.

The response rate to the surveys was good. Of the 166 plant questionnaires sent out, 93 were returned and those completed surveys covered 85% of the membership in auto. The office sample was much smaller. Twenty-three were mailed out and 12 were returned, for a coverage rate of 65% of office membership in auto.

Case Studies

The other major component of the research project involved a series of detailed case studies at selected sites in the industry, as well as a number of roundtable sessions. Roundtables were conducted where case studies were either not practical or where a wider sector approach was chosen.

The case studies, although limited to seven in number, tried to cover the various stages of auto production — tool and die, stamping, engines, trim and glass, final assembly. Again, given the limits, they were also chosen to represent different sectors of the industry (independent, captive and major assemblers) in different geographical locations:

- Ford Glass, Niagara Falls, Ont.
- Chrysler Mini-Van plant, Windsor, Ont.
- GM Truck Plant, Oshawa, Ont.
- CanFab and the Trim Plants, Stratford, Ajax and Windsor, Ont.
- An Engine Plant, (anonymous)
- Budd Canada, Kitchener, Ont.
- Paragon Tool, Windsor, Ont.

The structure of each case study varied somewhat from location to location, but they all shared the same central elements. Each was conducted over a period of between four and five days spent at the plant. The exception to this rule was Paragon Tool. In the case of Paragon there was an initial one day plant visit supplemented by the Tool and Die Roundtable and by a follow-up meeting with designated workers from Paragon. Most of the time spent at the plants was consecutive. The exception here was GM, where the visits were spread over a period of months to coincide with the transition, shut-down and start-up schedule of the remodelled plant. Often a separate plant tour was organized in advance of the actual case study visits.

The case studies relied on three sources of information: interviews, documentary materials and direct observation of operations. The interviews varied considerably in their setting, length and number. Some were structured, tape-recorded events while others were more informal conversations on the shop floor. At the level of management, researchers interviewed both front line supervisors and front office managers. Amongst the latter the emphasis was on Industrial Relations, Industrial Engineering and, if separate, those responsible for training, SPC and JIT. Workers from both the skilled and production classifications, workers in indirect and support jobs, workers directly affected and those only indirectly affected by technological change were also interviewed. Local union representatives and leaders were interviewed as well.

In addition to these individual interviews the researchers conducted — with union and management cooperation — focus group discussions in most locations. The focus groups were composed of between five and eight workers selected from different lines and departments and who had different experiences with new technology. The actual selection of participants varied from location to location. The usual process involved the researchers suggesting areas, the local union suggesting individuals, and management approving the selection as long as production requirements were not interfered with. The focus groups lasted three to four hours and were all audio

taped with the permission of the participants. The interviews and focus groups were the most valuable sources of information for the case studies.

The case studies also relied on documentary information. These materials covered a broad spectrum of information; plant layout schemata, production flows and manpower requirements; corporate policy statements; detailed training outlines and courses; meeting agendas and minutes; and the usual public relations handouts.

The final methodological tool available to the researchers was generally unrestricted access to the plants. The opportunity to observe what is done and how it is done; developing a sense of the overall production process and how its parts are related; seeing new technology in action, as well as its inaction; and watching what workers actually do went a long way toward framing the present report.

While all of the case studies dealt with the same set of common issues, some emerged with a particular emphasis. At Budd, for example, the focus was on the EI program. At the engine plant the emphasis was on job loss. At the trim plant the question was whether the same technology could lead to different job designs. Furthermore, some of the case studies were written up as detailed reports while others were used primarily to inform the final report.

Roundtables

In addition to the plant-specific case studies, three roundtable sessions were organized. The first invited local union reps from the Tool, Mold and Die sector and involved about fifteen people who met in Windsor to discuss the issue of technological change. The second roundtable was held in Montreal and involved about twenty five people from auto plants, parts depots and repair garages in Quebec. The third roundtable was held in Toronto and involved representatives from CAW automotive offices.

The researchers were also invited on a number of plant tours of facilities that were not case study locations, and attended a number of special events, workshops and company briefings on new technology.

REPORT OUTLINE

The format of the final report is more open and exploratory than structured and explanatory. The choice is breadth over depth of analysis. Any one issue, whether a particular technology such as robots or a particular issue such as training, could warrant an in-depth study on its own. Instead we have attempted to provide a reasonably clear account of the issues associated with the introduction of new technology and an accurate and concise reporting of how workers, in particular, and management more generally, perceive and react to technological change. The record of our observations and reflections is meant to be more descriptive than analytic, our conclusions more tentative than definite. The report relies heavily on data from the Technology Survey and description and analysis from the case studies and roundtables. Throughout the report extensive use has been made of excerpts from case studies and, wherever possible, direct quotes from workers and management, in order to support arguments and provide illustration.

The report is comprised of the following six chapters:

1. **The New Technology**
   - a broad definition of technological change
   - developments in process, product and equipment
   - equipment and organizational technologies
   - an assessment and description of the major technologies currently in use in the automotive sector
   - the scope and pace of technological change
   - possible limits on technology

2. **Disappearing Jobs**
   - technological displacements and layoffs
   - technology and vulnerable jobs
   - the offsets to job loss

3. **Transformation of Work**
   - changes in the organization of work
   - working with new technology
   - the conflicting trends in technological change

4. **The New Management Agenda**
   - the new philosophy
   - workplace initiatives
   - trends in labour relations

5. **Labour and Technological Change**
   - process of technological change
   - collective agreements
   - new training demands and initiatives

6. **Policy Implications**
   - the challenge for labour
   - a starting point

ACKNOWLEDGEMENTS

The project in general, and the researchers in particular, are indebted to a great many people. It is obviously a case of an abundance of riches. Unfortunately it is not possible to thank everyone individually. But to those who spent the time responding to a very detailed and time-consuming questionnaire, to those who shepherded us around plants and arranged meetings and interviews, who explained the obvious with great patience, who participated in interviews and focus groups, whose schedules were interrupted by ours, and whose workload was increased by our requirements, and who, wherever we went, responded with concern and enthusiasm, a great deal is owed.

THE NEW TECHNOLOGIES

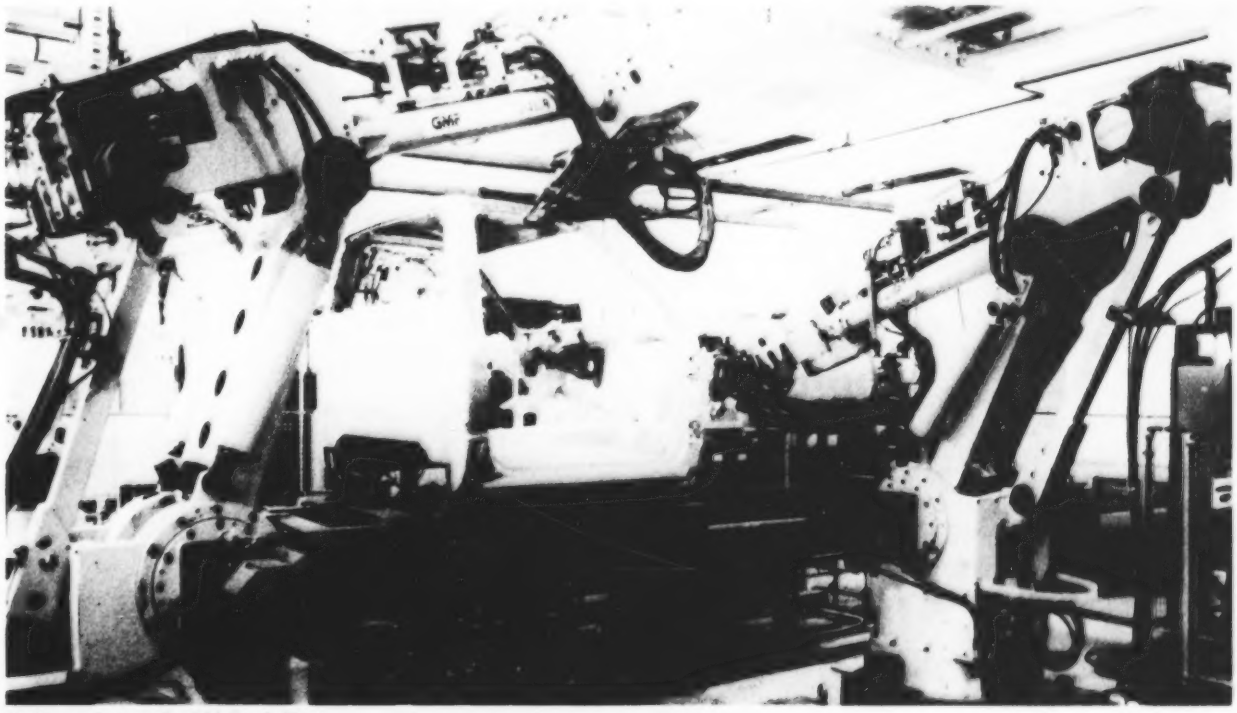
By the late seventies the world economy had entered a prolonged economic slump. In the automotive sector the downturn was particularly sharp. Rising oil prices, shifts in market demand and a flood of imports were the most visible reasons for a weakened North American industry. But behind these immediate reasons lay a more fundamental change — the automotive production system was being transformed. The industry had entered a period of dramatic technical and structural upheaval. The product was changing, production processes were changing and the social organization of production was changing. The industry was in a phase of global restructuring with the very survival of particular companies put at stake.

Prior to the late seventies North American producers dominated the world automotive industry. By the close of the decade that had changed. The industry had become more international in addition to it being transnational. Domestic markets were fragmenting, core automotive design concepts were being reshaped, the North American model of the factory was being challenged and industrial production was being transferred. At a time of declining profitability, slowing productivity gains and growing excess capacity, the North American industry had to contend with competitors that were shifting the grounds of competition.

In their response to off-shore competition North American producers have adopted a multi-faceted strategy. In some locations (U.S.) workers have been whipsawed into concession bargaining. In others older plants have been closed down as companies rationalize their operations. More component production and sub-assembly operations have been outsourced and new domestic and foreign joint-ventures have been established. The number of suppliers have been reduced and supply relations have been re-organized. New 'greenfield' production sites have been constructed and in both old and new plants the shop floor has taken on a renewed importance in corporate efforts to restore manufacturing competitiveness. Throughout the system the corporate goal of reducing costs, increasing productivity and improving product quality has taken on a new sense of urgency. And in all cases new technology features prominently in the solution. Whatever else the game plan, the North American industry is betting heavily on technological change to reshape its products, processes and relations of production.

TECHNOLOGY IN THE AUTO INDUSTRY

The automotive industry has historically been a leader in the application of new technology. Ever since Henry Ford cranked up the assembly line back in 1914, the product — automobile — and the concept — technology — have been closely linked. Even the word 'automation' itself is a product of the automobile industry. It was coined back in 1952 by a Ford engineer to describe the automated transfer line machining operations at the new Cleveland engine plant. This association has continued, more recently with robots. The industry boasts the first industrial application of robotics but, more importantly, without the auto industry there would be little demand for robots. In



GM Employee Communication Centre

Welding robots at the GM Truck Plant.

Canada, for instance, the auto industry accounts for about 75% of the installed robot population.

Historically a major user of technology, the industry is also becoming an important producer of technology. GM has bought into a robot manufacturer — Fanuc of Japan — and created GMF Robotics. It has spent over $2 billion to acquire EDS (Electronic Data Systems), a leading software and computer applications company. While GM may be unique in this regard, the other major producers are involved, if not in the actual manufacture of technology, then in its development for industrial use. Ford, for example, has its robotics and automation centre and a number of the Majors are members of MAP (Manufacturing Automation Protocol) and TOP (Technical and Office Protocol). These programs, which also include leading non-auto companies, were established to develop common 'interface' communications systems in order to facilitate both factory and office automation and the link between them.

The application of advanced manufacturing and information technologies is clearly at the forefront of the North American industry's strategy for competing with foreign producers. The industry is currently investing billions of dollars in new factories, new equipment, new work processes, new materials and new products. When Chrysler rebuilt its Windsor assembly plant #3 in 1983 to produce the T-series mini van, an information pamphlet published by the company described the new plant in this way:

> "The plant you are returning to will be a showcase for the world with its new production concepts ... The plant has been transformed into a sophisticated, advanced assembly facility employing the latest state-of-the-art technology. We will be working together in the most complex, highly advanced plant in the world ..."

The converted plant contained some of the most advanced technology in the industry, including 123 robots, a guided vehicle stock delivery system, optical laser gauging systems, a Just-in-Time delivery system, and three North American industry firsts: an "in-line sequencing" system of scheduling and tracking vehicle build-up from sub-assembly right through to final car; an eight stage full-immersion phosphate and uni-prime paint undercoat dipping system; and the application of robots to paint spraying operations. Since then Chrysler has added another 25 robots, it has introduced Statistical Process Control, it has refined a Factory Information System, and it is in the process of implementing a sophisticated equipment communications hookup that will integrate its entire operation with Chrysler Headquarters in Detroit.

Scarcely three years after Chrysler announced its path breaking assembly plant, GM completed the truck plant phase of its $2 billion 'Autoplex' renovation in Oshawa:

> "Beginning with the 1987 model year General Motors will begin production of the new, state of the art, world competitive truck, the GMT 400. This completely new vehicle will be assembled in the most technologically advanced automobile assembly facility in the world — the Oshawa truck plant ... With the advent of AGV floor carrier systems, entirely automoted body weld processes, a revolutionary multiple loop painting system and the most powerful plant computer system ever, it is no small wonder that we will be considered the world's automotive industry technological leader ... The new technology that is being introduced into our plant is unparalled within the GM corporation and throughout the world."

At the truck plant the assembly line pioneered by Ford has actually been replaced.

The auto industry in North America is counting on innovations — in the production process, in work organization, in labour-management relations, and in vehicle design — to help rescue it from the seige of low cost offshore competition. North American producers are relying on new technology to help them regain their historic dominance.

NEW TECHNOLOGY

There are three distinct but related categories of new technology in the auto industry. They are product, equipment and process technologies.

1) Product technology refers to the technology built into the product itself, such as dashboard computers, plastic body panels and new heated windshields. Product innovations usually involve a combination of design elements, new components and material substitution. Automobiles are now being designed for assembly. In other words there is a much closer relationship between the design departments and the production facilities where vehicles are actually built. Innovations in components or in the arrangement of components, such as super-charged, fuel injected engines and front-wheel drives, have become widespread. And new materials — such as the experimental ceramic engines — and material substitutes — such as the shift to aluminum and plastic in place of steel — are all part of the product changes occassioned by demands for fuel efficiency and the resulting down-sizing of the North American auto fleet.

2) Equipment Technology essentially refers to the introduction of computers — programmable controllers — into, or in tandem with, equipment and machinery used to manufacture and assemble automotive parts and vehicles. Specific equipment technologies vary considerably with the production task, but include such equipment as robots, CNC's, lasers, automatic presses, and Automated Guided Vehicles (AGV's).

3) Process technology refers to the overall state of the manufacturing system itself, as well as particular procedural innovations within it. It refers to the organization of production, the interaction of people and machines, and new work procedures. Process technologies include such innovations as the new quality assurance procedures of statistical process control (SPC), just-in-time (JIT) production, delivery and inventory process and the introduction of work management concepts such as teamwork, multi-functionality, self-inspection, problem-solving and participation.

Developments in any one of these areas affect what is produced, how it is produced and, ultimately, how many

people are required to produce it. Furthermore, innovations in one technology usually generate innovations in other technologies. The trend to small cars, for example, has led to increased use of lighter galvanized steel in stamping plants. In turn the lighter steel and smaller chassis parts facilitated the introduction of automated press lines and multi-die presses in stamping plants. A typical car bucket seat — another example — is presently constructed of anywhere from 20 to 40 pieces of foam and fabric that have to be cut, bonded and sewn together, and then fit over a frame of metal strapping and springs. But developments with the 'foam in place' seat, a one-piece seat that is formed by inflating the cover with injected foam, could replace some of the cut and sew operations in a trim plant. In both these cases a development in one technology suggests innovations in other areas.

This process is characteristic of technological change in the auto industry. The concept on new technology refers to innovations and developments in product, equipment and process technologies, but more importantly it refers to the convergence of all three in the workplace.

When Ford developed the assembly line, automotive production was transformed. The assembly line was the culmination of changes in the product, the equipment and the process of production; in turn, it generated innovations on all three fronts. Mass production, a standardized product (Model T), specialized tools, backward integration, new inventory processes, changed relationships with suppliers, and regional assembly plants were all components of the same set of changes. More important from the perspective of those who built the cars, the assembly line meant a dramatically changed relationship to the tools and machinery of production, fundamental changes in the management of work, and significant changes in the terms and conditions of work. Workers were faced with jobs that had become compartmentalized and had been fragmented into discrete, repetitive and monotonous tasks. These changes influenced and shaped workers reactions and demands. In turn, in order to deal with rapid staff turnover and maintain the mass production requirements of the new assembly line process, the work day was reduced to eight hours and wages were virtually doubled.

The changes occassioned by new technology today are potentially as far reaching as those early ones. Technological change has come to mean changes in the number and the mix of jobs; changes in the way the job is done, the content of the job and in the skills required to do the job; changes in equipment, machinery and tools; changes in the processes and the methods of production; changes in shop floor relations, in management strategies and styles and in labour-management relations; changes in supplier relations; changes in the product and changes in production. Management sees, in the developments associated with current restructuring efforts, an opportunity to shape, in the words of a GM document, a new 'Manufacturing Utopia', and in the process they have forged a new corporate trinity — Quality, Productivity and Efficiency.

As a model of production the assembly line encouraged mass production and economies of scale. The current changes encourage flexible production and what could be called economies of scope.

MANUFACTURING UTOPIA

- equipment uptimes over 90%
- consistently capable processes
- reject rates of .5% or less
- high-speed, high-output equipment
- capable, reliable suppliers
- skilled, flexible workforce
- non-value added work: 5% or less
- point of use layouts without conveyors and storage systems
- just-in-time delivery and shipping
- involved workforce
- no non-value added investment
- reduced inventory, fewer containers and checkers
- rapid response to problems and fewer problems
- no repair/salvage areas
- fewer indirect support people
- etc., etc., etc.

PROGRAMMABLE AUTOMATION

Automation is not new. Neither is concern with its impact. Some in the industry recall the 'Automation Scare' of the fifties when the popular and business press heralded developments at the the Ford Cleveland engine plant (and elsewhere in the industry) as a watershed in the evolution of production. Then, as now, the new 'supermechanization' was greeted as the beginning of an era of jobless growth and the potential achievement of production without workers.

But it is with these predictions that most of the similarities between the periods end. In the fifties the basic model of production — its product and processes as well as its relations — were not challenged nor altered by automation. Furthermore, automation was, by and large, restricted to capital intensive component production. The equipment it spawned was fixed — dedicated, single-purpose machinery. Today technology is changing all aspects of production and new automated equipment is programmable and, therefore, flexible. Whether it is used in flexible production or not, the technology remains programmable. These differences are not simply differences in degree, they are differences of substance and outcomes. Programmable automation differs from conventional factory automation by relying on information to provide machine control, feedback and communication.

Computers are finding their way into every stage of the production process, from programmable controllers monitoring and commanding the new equipment — including robot welding lines, CNC machine tools and automated warehouses — to CAD/CAM and other information and design systems linking the shop floor directly with product designers, engineers and managers. Computers have revolutionized shop floor equipment; they have converted fixed mechanization into flexible automation.

Robots

Robots are far and away the most common new equipment technology in use today. Data from the CAW Technology Survey indicates that there are literally hundreds of robots in use in the industry; in sampled plants there were an

estimated 700 robots. Robots represent a relatively simple task replacement technology. They are best suited to simple, repetitive work that has a consistent pattern and little variation. The Ford Robotics and Automation Applications Consulting Center defines a robot as:

> "a reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks."

Whatever the formal definition, a robot's essential function is to duplicate regularized human movement. The application of robots in the auto industry reflects this characteristic. The majority of robots reported in the Technology Survey — close to 60% — are used in spot-welding applications. A further 20% are used for material handling and machine loading/unloading, about 10% are used in spray painting operations and the remainder are involved in a variety of operations, including basic assembly.

In the future the diffusion of robotics will be more rapid

THE SCOPE, TIMING AND PACE OF TECHNOLOGICAL CHANGE

Evidence from the CAW Technology Survey suggests that technological change in the automotive sector is extensive, it is recent and it is accelerating.

Scope

The use of new technology in the industry is quite extensive and there is a wide range of technology in place. The overwhelming majority of respondents to the Technology Survey reported the introduction of some new technology in their workplaces. On the equipment side the most common new technology was robots; on the process side the most frequent response was statistical process control (SPC).

- robots are reported in 40% of workplaces
- computer controlled machine tools (CNC) in 27%
- other computer controlled equipment in 55%
- automated material handling systems (AMHS) in 17%
- computer assisted design (CAD) in 12%
- Just-in-Time (JIT) in 50% of workplaces
- statistical process control (SPC) in 80%
- quick tool and die change techniques (QTD) in 20%
- linked or integrated systems in 20% of workplaces.

While new technology is becoming commonplace, it is unevenly distributed across the industry. To the Technology Survey question, 'Do you have an Automated Material Handling System in your plant?', the answers ranged from one describing an automated, multi-level, computer controlled warehouse to one reporting the operation of a forklift. The uneven distribution is not surprising considering the variation in production within the sector and the incredible range of companies which make up the industry.

There are a variety of technological strategies in the industry. Some plants make extensive use of a number of different technologies while others utilize only one or two different types. In addition, some plants use a few particular technologies very intensively. There is also variation in the depth and breadth of new technology. The survey results point to a cluster of plants that use a significantly wider variety of technology, and do so more intensively, than other plants in the sector. In other words they have robots and CAD and CNC and JIT and SPC and virtually every other acronym on the market. These plants have also begun to integrate various levels and functions of production through the application of new technology. Not surprisingly, these plants are relatively large and concentrated in the captive parts and vehicle assembly sections.

Timing

Most of the technology applications are recent. Over 60% of the plants which have introduced equipment technology — robots, NC/CNC equipment, automated material handling equipment and CAD systems — have done so within the last five years. Innovations in process technology — JIT, SPC, quick tool and die change — show a similar trend. The earliest reported use of Just-in-time systems in the CAW Technology Survey is 1981, and over 85% of those with JIT have had it for less than five years. Fully 90% of all SPC users — the most widely reported procedural technology in the industry — have had it in place for less than five years. In fact, two out of every three SPC users have introduced the system within the last two years.

Pace

To the issue of scope and timing must be added the question of pace. The introduction of new technology is not only recent, it is also accelerating. Half of the those who responded to the Technology Survey described the introduction of new technology in their plants as accelerating. Fully two thirds of the group of extensive technology users anticipate a more rapid rate of technological change in the near future.

The recentness and accelerating pace of change, combined with the already widespread use of new technology, underscores the need to assess its impact. Since technological change is extensive its effects are far reaching; since it is recent its impacts are just beginning; since it is accelerating its impacts will increase. And because the industry is at a threshold of technological change, the opportunity exists for influencing future outcomes.

and the distribution will shift increasingly toward assembly functions. For example, at one point GM alone anticipated using 14,000 robots by the end of the decade, an increase of over 500% from the 2,300 in place in 1983. Furthermore, robots used for assembly operations were expected to increase over six fold, such that by 1990 assembly applications were to constitute the largest application of industrial robots. While GM has since scaled down these estimates, the general trend lines remain the same.

Computer Numerical Control

The first application of programmable automation in the auto industry dates back to the "fifties" and the introduction of numerically controlled machine tools (NC's) into metal working shops. NC's are machine tools that cut, grind, bore and shape metal according to instructions programmed on paper or plastic tape. The addition of computer controllers to these machines have made them flexible, accurate and powerful. Computer control has also made it possible to change the coded instructions right at the machine or at some location (i.e. the front office) removed from the machine. These CNC's, as the Computer Numerical Control machines are called, are capable of performing machining operations that formerly required the active involvement of skilled machinists; the computer program governs the rate, direction and speed of the feed, regulates the flow of coolant, monitors tool wear and can automatically change tools. CNC machines are as diverse as the metal working operations they perform and, increasingly, new generation machines are capable of more complex and multiple operations.

The application of NC/CNC in the Canadian auto industry remains rather limited. Most applications are found in the tool, mold and die shops, particularly those involved in batch production as opposed to one-of-a-kind die preparation. Some CNCs are in place in tool and maintenance shops in stamping plants, others are part of the in-line machining operations in engine plants.

CNC Machining Centre.

Ontario Centre for Advanced Manufacturing

CASE STUDY

- At Paragon Tool in Windsor the CNC — a duplicating machine — was installed in 1985. The operator places the wooden pattern of the die on the bed of the CNC and, by tracing the shape of the pattern, automatically programs the coordinates onto the disk of the CNC's computer. Once the model has been traced it is removed from the work table of the machine and replaced with a block of steel. The operator then starts up the CNC and the machine automatically cuts the steel into shape.

  The CNC at Paragon has one other feature; it is a machining centre. In other words the CNC has the capability to control a number of other duplicating machines from the same computer. In the case of Paragon two other duplicators in the shop will be hooked up in-sequence with the CNC. This will enable one operator at the CNC to run three machines at the same time, each producing a duplicate of the original wooden model.

Paragon Tool

Other Computer Controlled Equipment

There is an incredible variety of computer controlled equipment technology in use in the auto industry. Computers are used in design operations, for material handling, and in manufacturing and inspection operations. Some of the new technology is specific to particular operations while others have more general applications. Examples include:

- the NC cutters in glass plants, programmed cutting systems that cut windshields out of glass sheets.
- the Gerber cutters in the trim plants, which are computer controlled machines for cutting cloth and vinyl for use in seats, interior trim and door panels.
- the L/K booth at Ford Essex engine, which is a computerized test probe used to check the specifications on various machined engine components.
- the CAD system at Rockwell, Milton where draftsmen work out specifications for assembly lines and transfer lines on a computer terminal.
- at UAP and IPA in Quebec, where computerized ordering systems enable direct link-up between customers and the supplying warehouse.
- computerized engine testing equipment in International Elite Trucks and Cummins Diesel in Quebec that automatically diagnoses defective parts and trouble spots in the engine.
- the personal computers on the desks in offices, and the terminals and printers on the shop floor.

PROCESS TECHNOLOGY

The computerization of production facilitates the flow of information on the shop floor, between the shop floor and various levels of management, and among suppliers, manufacturers and customers. The improved communica-

tion results in better coordination of factory operations, more management control over production and has led to a number of organizational and procedural innovations. These changes, taken together, are as important to improved quality, productivity and efficiency as specific equipment technologies.

CASE STUDY

- Although the equipment technology is evident in the press shop it is the procedural innovations that have made some of the most dramatic impacts. The Quick Tool and Die change (QTD) program is an example. It was introduced at Budd Canada in 1983. At that time an average changeover of dies — from press shut down to first off — took roughly fifteen hours. Three years later an average die change takes five hours.

  The importance of reducing die change times in the press shop is straightforward: fewer hours spent changing dies and keeping presses idle means more hours for production. Put another way, a reduction in die change time translates into an increase in production capacity in the press shop without the addition of new equipment.

Budd Canada

Statistical Process Control (SPC)

SPC is perhaps the most common procedural innovation in the industry. Its popularity stems from the industry's growing concern with quality production and their past failure to achieve it. SPC is essentially a mathematical procedure for determining and monitoring the variation in specifications from one part to the next. A sample of parts or vehicles is taken at various stages of the production process. Measurements of critical specifications are taken on each part and recorded. The variation in these measurements is determined and then plotted over time at each stage of the production process to determine if acceptable quality levels are being achieved. If a severe quality breakdown is identified the source of the problem can be pinpointed and corrected before too many defective parts have passed through the system.

SPC is more than a statistical procedure; it is symbolic of a shift in production philosophy — "building quality in" rather than "inspecting quality out"; it is a tactical device for developing worker commitment to production, for changing production relations; it is an essential precondition to other changes in production, such as the shift to JIT. At one level SPC is just charts and figures. At another level it is an expression of the broad range of changes associated with new technology.

Like all applications of new technology in the auto industry, there are considerable differences in the way companies implement SPC. In some plants line workers have become directly involved in monitoring and inspecting production, in other cases inspectors have taken on SPC functions and in still others it is strictly a management function.

- At Budd, hourly workers are trained in all aspects of SPC; SPC worker-interns are involved in the recording of specs through to calculating and charting variations and interpreting results. There are SPC groups involved with identifying and resolving quality problems.
- At Chrysler SPC auditors move around some departments in the plant taking measurements on hand-held "digi-mite" gauges — essentially portable mini computers. Information is stored in the digi-mites memory and then fed into a mainframe computer which calculates and prints out specification variation. In other areas the supervisors measure, record and plot the variations on charts which are subsequently analyzed by the SPC auditors. Hourly workers are not involved in any stage of the process.

In some cases SPC has resulted in appreciable differences in quality. In other locations, however, all the hype and cheerleading hasn't convinced those on the floor that SPC has made a difference.

- "SPC is wonderful if its doesn't interfere with production."
- "Around here pieces are scrap until they need them."
- "I've done SPC charts and I've seen them white-out what I've done, change them and photocopy them."
- "If you can't get the first part to meet the specs, change the specs."

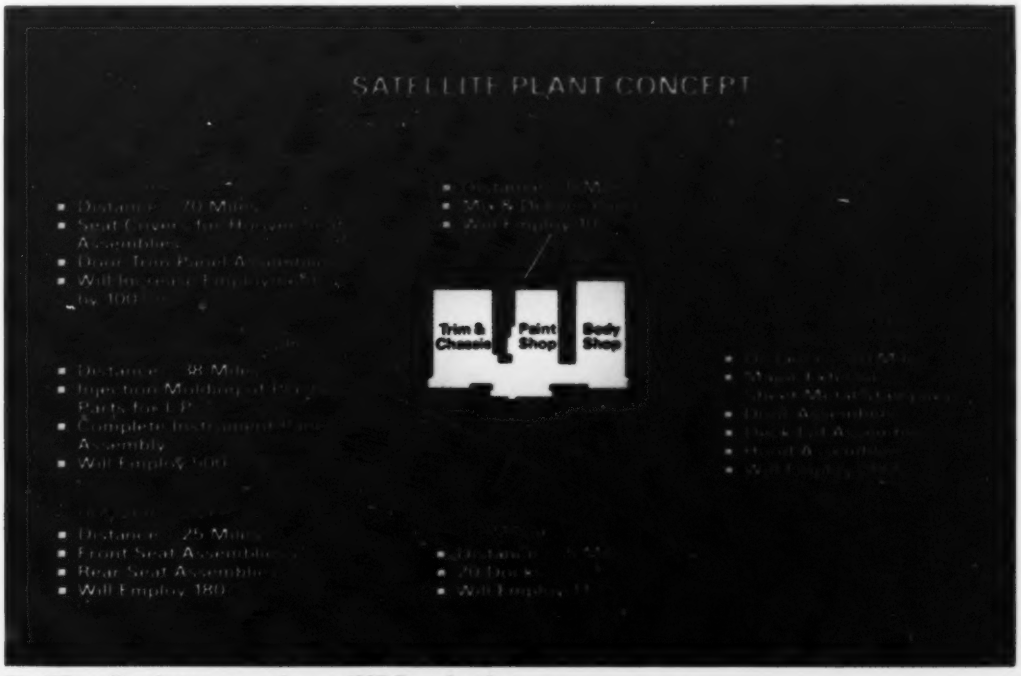
Just in Time (JIT)

Computerized information and communication systems have allowed manufacturers to better coordinate supplier shipping schedules with their own production needs. Just-in-time delivery is one of the results of this improved coordination and information flow. JIT, like SPC, is a production concept advanced by the Japanese. In production terms it means producing what is needed, when it is needed, in the quantity that is needed. In inventory terms it means a 'fill-up' rather than 'pile-up' stocking system.

The popularity of JIT is easy to appreciate. The double-digit interest rates of the recent past awakened producers to the high cost involved in stockpiling huge inventories. In the short term JIT was a way for the major producers to shift the costs of carrying inventory onto suppliers. In the longer term, once (and if) the entire production system has converted to JIT, costly inventories will be eliminated altogether. Production will be streamlined; parts and materials will arrive at the plant just hours before they're needed and will be delivered in the plant just as they are being used.

In addition to changing production philosophies, JIT can change the physical layout of plants and the geographical relations among companies.

- As part of the reconstruction of the GM Truck plant for the GM Autoplex project a ring road was built around the entire facility to accommodate the truck traffic generated by JIT; GM estimates that upwards of 500



The JIT satellite plant system at the new AMC Bramalea plant.

transport trucks will make parts deliveries to the new complex on a daily basis. The new facility was also built with ninety-two loading bays throughout the complex to facilitate the speedy flow of incoming material to the plant floor.

- The new AMC assembly plant in Bramalea is to be on a JIT basis with its suppliers. Suppliers have to have a facility located within 70 kilometers of the new plant in order to meet AMC JIT requirements. In addition AMC has built a new satellite plant in Guelph, within the geographic limits, to supply the new assembly plant with instrument panels, steering columns and other plastic trim.

JIT places an increasing amount of pressure on the smooth functioning of the entire production process: deliveries must arrive on time; parts must be of a consistent, high quality; machine downtimes during manufacturing must be minimized in order to ensure that orders will be filled on schedule. JIT necessitates a closer integration of all facets of production, and in so doing it increases management's control over production. But a more closely integrated production system with minimal room for error also increases mangement's reliance on workers. The result has been a new emphasis on securing the participation and voluntary commitment of workers to production.

TOWARD AUTOMATED SYSTEMS

At present technological change involves a step-wise progression through three phases of automation, each more complex and consequential than the one preceding it. At times different parts of the same plant can be operating with different phases of technology and technological change can affect some areas while leaving others virtually untouched.

1) The first phase of technological change in the auto industry is characterized by the introduction of relatively simple **task replacement or substitution automation.** Robots are typical of this phase. What was formely done by a person is now done by a machine or no longer need be done at all.

2) In the second phase an element of coordination and integration is introduced. Isolated pieces of equipment are linked together in what could be called **islands of automation.** At this stage tasks are not only substituted, they are redefined. In the first instance jobs are displaced, in the second more are displaced while others are changed. As jobs are changed, so too are the relations between people and machines and between people themselves. Typical of this second phase would be CNC machining cells or specific technology lines such as automated windshield cutting lines in glass plants.

3) The third phase is the achievement of management's "new technology aspiration" — **a completely integrated system of automated production.** This would involve both the horizontal and the vertical integration of various technologies. Horizontal describes the integration of technology on the shop floor into a flexible manufacturing system (FMS); vertical refers to linking shop floor technology directly with that of the front office. In other words, the third phase of technology means achieving a computer integrated manufacturing system (CIM).

The use of programmable automation in the integrated systems envisioned by the third stage is obviously much more powerful than its use in stand-alone application. Computer integration not only magnifies the productivity and the efficiency of production, it induces changes in the

entire system of production. It is a case of the whole being greater than the sum of its parts. The degree to which technology approaches system applications is the degree to which technological change moves the production system beyond incremental change.

The drive toward integrated systems and technology-intensive production, however, has its counter tendencies, its barriers and its obstacles. Although the greatest virtue of the new programmable automation is its flexibility, most applications of new technology are actually in fixed production situations. When more and more is riding on reliable, consistent output, the realization that 'bugs' in the system are actually permanent and unpredictable features, has led management to some reassessments.

At the same time as GM is building the most technically advanced assembly plant in the world at Oshawa, it is replacing its robot spray painting operation in its Cadillac assembly plant in Michigan with a new system of automation which includes workers. At the same time as the North American industry is trying to 'out-technologize' the Japanese, and trying to automate its way out of production inefficiencies, it is already concerned that it has over-automated production.

Despite these 'second thoughts', the technical and social base of production is, and will continue to be, transformed. Technological change is already having a profound effect on workers and the work they do. All indications suggest it will continue to do so.

At times technological change is incremental and evolutionary, with the successes of previous generations and operations reproduced, consolidated and built upon the next time around. But at other times technological change is less evolutionary, the factors of change become more variable, the outcomes less predictable and the extent and degree of change more fundamental. These latter periods are times of instability where changes along a number of dimensions converge to disrupt and alter established models and patterns. North American automobile production is in one of those periods.

NEW TECHNOLOGY SUMMARY

- In its response to global competition and declining rates of profitability and productivity, the North American auto industry has developed a new manufacturing strategy. A major component of the strategy involves new technology.
- Corporations are betting heavily on new technology to restore their manufacturing competitiveness.
- There are three distinct but related categories of new technology in the industry. These are product, equipment and process technologies.
- Changes in all three of these technologies and their convergence in the workplace are restructuring production, influencing manufacturing outcomes and are affecting job numbers, job design and content, the organization of work and the relations of work.
- What is emerging is a new model of North American manufacturing.
- The introduction of equipment and process technology in the auto industry is recent, it is quite extensive, but with considerable variation in its application, and the pace of its introduction appears to be accelerating.
- On the equipment side, robots were the most frequently reported technology. On the process side, statistical process control (SPC) was the most frequently cited example. For both equipment and process, the majority of respondents indicate that its introduction has occurred in the five years since 1982.
- A group of primarily large companies use technology both intensively and extensively — a large variety of technologies, numerous applications of each, with a growing integration of different operations.
- On a workplace basis the introduction of technology generally evolves from stand alone applications through to integrated systems. The three stages in the process can be characterized as 'task substitution', 'islands of automation', and finally 'systems of automation'.
- The first instance is exemplified by a single robot performing the task formerly done by a person. Islands of automation suggest pockets of integrated applications where, for instance, a robot feeds parts to an automated lathe, press line or windshield cutting machine. The system application implies a series of islands linked together in a computer controlled and monitored feedback system which extends from the front office or head office to the shop floor.
- In the auto industry the bulk of technological change remains at the first two levels, with notable examples and developments at the third level. While the first two levels have clear and dramatic impacts it is at the stage of computer integrated manufacturing that production is radically transformed.
- Because the implementation of technology is extensive in the automotive industry, it has widespread impacts. Because there is a wide range in use, impacts are uneven and variable. Because its arrival is recent, effects are not fully assessed nor determined.
- These points, combined with the realization that technological change is accelerating, suggest that the present is a strategic time to influence and shape future outcomes.

DISAPPEARING JOBS

Automation eliminates jobs. As a general trend, the introduction of new technology — be it computer-based machinery or new management systems — reduces the number of jobs. That is not surprising. The design of new technology and the way it is implemented are motivated by the desire to raise productivity while lowering the costs of production. In this sense technological change implies a widening gap between productivity and employment. As long as production volumes remain constant and technology improves the rate of productivity, the need for production workers will diminish. Most equipment is designed to reduce labour hours in the final product, and new machinery is marketed as a substitute for people.

- "We're trying to stay competitive with other people who had automated and who were reducing the labour content in the end product . . . We had to do something to get the cost out of processing the product and save some of the labour that was going into the product."

  Ford Glass Case Study, Management

- "I'm not going to be so naive to think, or expect you to believe, that there is not labour savings with the Gerber, because you're going to get labour savings."

  CanFab Case Study, Management

- "Our mandate, it's to use technology to get rid of the manpower. We have targets in terms of manpower, in terms of hours per car, and the only way to meet those targets and compete is to make sure that we're going to stay more efficient; be a low cost producer. The only way you can do it right now is through technology, or through developing a working relationship where everybody pitches in.

  Chrysler Case Study, Management

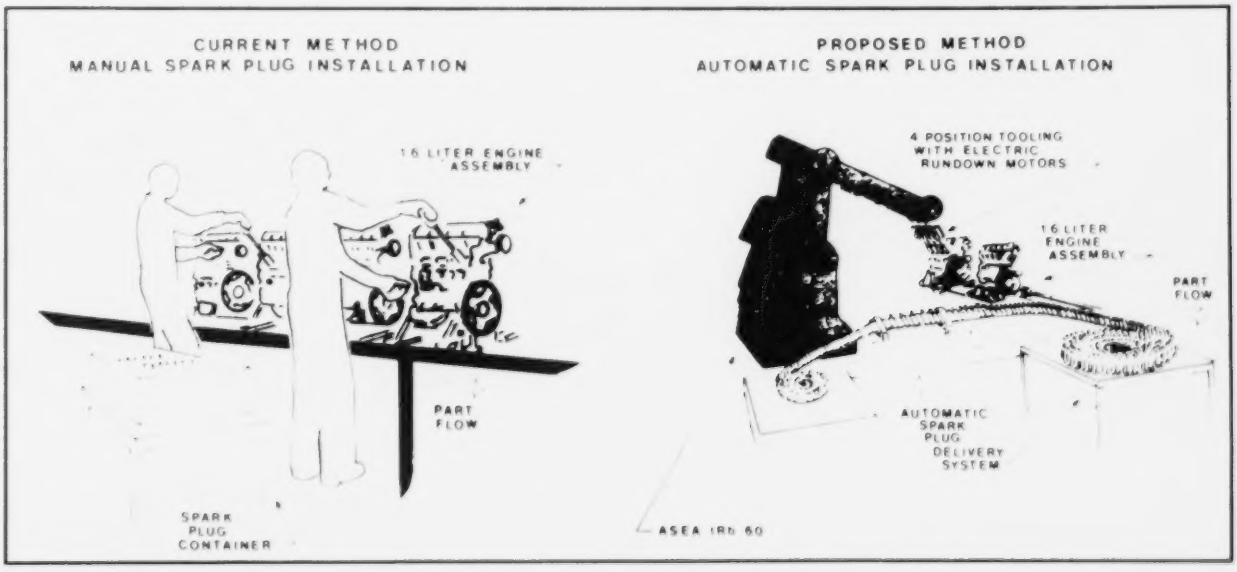
Assessing the impact of new technology on labour requirements is a difficult undertaking. The labour displacing potential of technology is subject to so many conditions, decisions and offsets that by the time the technology is in place there is often a gap between claim and achievement, between prediction and outcome, and between the results of a specific technological application and its general impact. Machines and equipment have shortcomings and possibilities that were not initially expected, breakdowns occur more or less frequently than anticipated, and factors independent of the technology come into play. All of these influence the final employment outcome.

While automation reduces the need for workers it rarely eliminates the need altogether. Automation requires human input for set-up, supervision, monitoring, inspection, adjustment, repair and 'just-in-case'. The unload robot on the automated glass cutting line at Ford Niagara, for instance, couldn't handle the new thin windshield of the Taurus/Sable without breaking it.

The new automated equipment on the engine assembly line in an engine plant required line-speeds too high to allow the one worker at the next station time to install the tappets. If the speed of the line was slowed the automated equipment wouldn't synchronize; a second worker was added to the tappet station. At CanFab the computer-controlled Gerber would cut cloth like butter but just wasn't effective when it came to cutting vinyl or foam.

JOB DISPLACEMENT AND LAYOFFS

While it is difficult to estimate the job loss associated with new technology, that doesn't mean the jury is still out. It may not be possible to be precise and say, for instance, that every robot will replace two workers, but it is possible to support the general formulation. What is clear is the trend: technology reduces the labour requirements in production.



Most jobs in an auto plant are composed of a series of specific, often repetitve, tasks. These particular tasks can be transferred to a machine or they can be eliminated by a change in the design of the product, a substitution of material or a change in the process flow of production. As a result, many workers find they are displaced as their jobs are eliminated by new technology. At times workers are displaced from one job just to find the next as vulnerable as the first.

There is a difference between technological displacement and technology lay-offs. It is the difference between 'job security' and 'employment security'. Many workers see their particular jobs as vulnerable to technological change, but they don't necessarily view their employment in the same way. In many techological change situations jobs are lost but not people. Evidence from the CAW Technology Survey reinforces the distinction between displacement and unemployment. Half the plants in the survey reported a loss of job positions as a result of technological change. A much smaller proportion report actual lay-offs associated with new technology.

Those plants reporting 'displacements' cover the spectrum of auto production, and they cover the range of new technologies; from tool and die shops to assembly plants in the first instance, and from SPC to robots in the second.

- At Windsor Tool and Die 'shapers' were displaced by CNC machines.
- At Standard Tube the number of inspectors was reduced as a result of SPC and welders were reduced by robotics.
- At Holmes Foundry grinders and oven tenders were displaced by new equipment.
- At ITT Milrod robots replaced job welders who were transferred to the punch press.
- At Chrysler in Windsor robots replaced painters.

Job Offsets

Whether job displacement translates into lay-offs depends on a number of factors. It depends a great deal on corporate policy. It depends on whether the timing and the pace of the introduction of new technology is orderly, planned and linked to the normal rate of attrition. It depends on whether production volumes increase, thereby providing displaced workers with jobs in other areas. It depends on whether new products are added to the mix in a way that accommodates the existing workforce and offsets the loss of jobs.

To date the impact of technology in many auto plants has been cushioned by some or all of these factors. Specific technological change situations have demonstrated that it is possible to introduce technology without layoffs.

Union Response

The eventual job fall-out of new technology also depends on the efforts and the success of the local union in 'negotiating' its implementation. At Budd Canada, for instance, the success of the Quick Tool and Die process was attributed to the involvement and active participation of workers. Although management admits there is no longer the need for as many die-setters as there was before, no one has lost their job. The union explained that 'no layoffs' was the price of their involvement. As one rep put it: "If any die-setters lose their job we pull out of that program, and

CASE STUDY

- At the GM truck plant in Oshawa the shift to the work island process of the AGV system, as well as the other renovations, was initially projected to require 400 less workers — about 15% of the workforce. Since that initial estimate Industrial Engineering has revised the figures on a number of occasions. The latest estimate is that, despite the expenditure of about $700 million and despite a substantial technological renovation, production at Oshawa will actually require about 200 more workers.

  As one manager explained: "it is better to estimate low and add jobs than it is to overestimate and take jobs away."

  Part of the reason for the incease in job numbers is because not all the technology originally projected is going into the plant. Furthermore, it should be remembered that even though there might be the same or marginally more workers, the expectation remains that production will climb from 45 jobs an hour to 60 jobs an hour. And the current estimate on jobs, like the ones which preceded it, can still change in either direction.

GM Truck

- When the Gerber was first installed at CanFab there were those who feared that it would "eventually replace the whole cutting room . . . all these people." But so far, after two years in operation, it hasn't. The Gerber has limits.

  Based on manufacturing specifications the Gerber is a significant labour displacer. But the conditions necessary to achieve the 'specs' are rarely found at CanFab. In Gerber terms CanFab is a relatively small shop with batch production. The Gerber's optimum capacity, on the othr hand, is mass production. Management at CanFab is aware of the discrepancy:

  "To get those labour savings you have to remember one thing. You have to have a good volume of product and that has been one of our handicaps. On the Gerber let's say the ideal cut is 50 ply and it takes 45 minutes to cut. But what if you only have orders to cut 10. Once you push the button that cutter starts, and whether its cutting 1, 2, or 50 ply it takes the same amount of time, so if you can keep your machine loaded to the maximum you're going to get corresponding benefits."

CanFab

CASE STUDY

- Since 1983 the company has installed the fully automated NC windshield cutting line, it has introduced an automated hole drilling operation and an automated transfer operation on the vent line, and it has spent millions on new technology and yet no one has been laid off. One manager has gone so far as to declare that the company would not introduce technology if it were to mean people on the street:

  "We've displaced quite a few people but we've laid no one off. We haven't lost a job in this plant. That was deliberate, it was planned and we worked hard to make that plan work."

Ford Glass

- "One of the things we're wrestling with is manpower eliminations. What we're proposing to the union is something called attrition. We're telling the union that we know we have to get down to a certain manpower level and we know where we're going in terms of hours per car. We're going to get there whether you help us or whether we do it alone. So rather than fighting over everything we're looking for their support.

  If we have to go in and say 'here's where we are and we have to eliminate two people in the trim division', we're looking for the union's support so that we can go down and work together on it and do something that makes sense — get the two people out. Then as a plant we're prepared to guarantee that nobody is going to get laid off because of that. We'll guarantee right now that nobody will be laid off.

  Now we need a little flexibility in terms of what we can do with employees (so) they'll probably go into what we call a central pool. Maybe they'll be used for housekeeping purposes or painting or something until the day comes when somebody in the plant either quits, dies or retires. We know we have a 7% attrition rate for the plant.

  So what we've proposed to the union is that we'll guarantee that we won't lay anybody off — we'll give you a stable workforce. And when we hit the periods of time when we're down we won't lay anybody off, and that includes things like outsourcing."

Chrysler, management

you can bet that die sets will take as long as they used to."

At an engine plant management has plans to replace a station of five workers with automated equipment and one worker. The union is arguing to keep two workers. At GM Truck management planned to eliminate sweepers and make their jobs part of the responsibility of each 'work group'. So far the union has successfully resisted that change and older workers remain behind their brooms.

But the union isn't always successful, and the various job offsets aren't always enough to prevent people from going out the door.

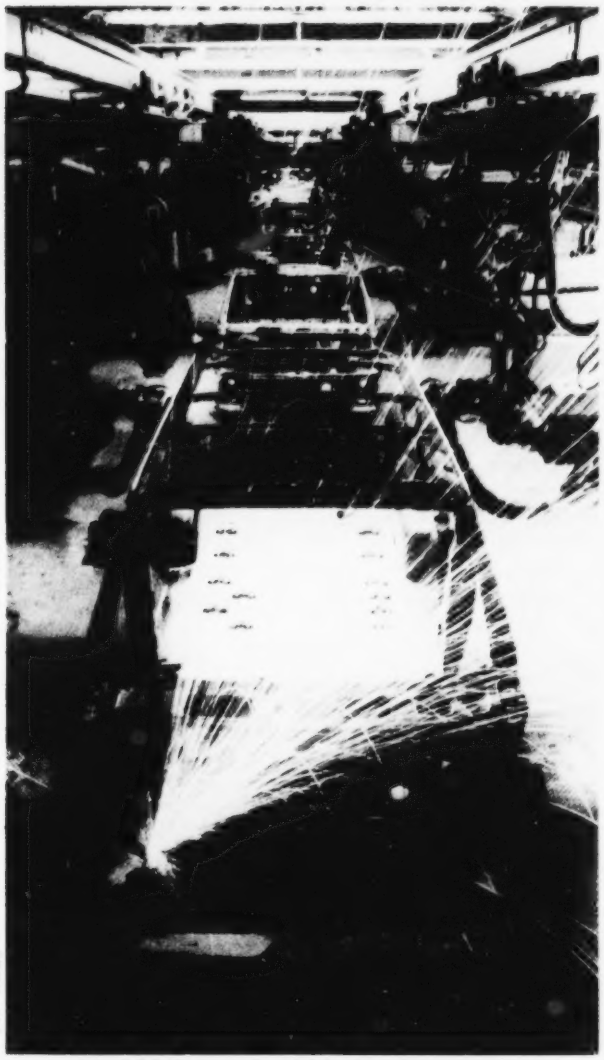
- Rockwell International. The furnace feeder was replaced by an automatic loader. Laid off and never called back.
- Excello Colonial. Six lathe employees were laid off and never returned when the company installed CNC lathes.
- Kelsey-Hayes, Eureka Foundry. Molders, shifters, dumpers and hopper men were replaced by the Osborne in-line-molding machine. Some of them were laid off.
- Ford Essex Aluminum. Metal pourers were laid off when the company introduced automated equipment.
- Kenworth Truck. The number of welders was reduced from 50-60 to 15-20. The number of painters was cut in half, from 60 to 30, when the company bought new automated equipment.

JOB LOSS AND SPECIFIC TECHNOLOGIES

The single-most-striking implication of computer based technology is its potential to eliminate jobs. In its simplest, most direct form, this is the potential of equipment to substitute for workers on a task by task basis. Historically, jobs have been broken down into a series of discrete, repetitive tasks tied to the rythmn of the machine. Now the machine is programmed to take over the task. Today a worker in the body shop is spot welding car roofs; tomorrow the job is being done by a robot. Less direct perhaps, but equally important, is the application of new information-based procedural initiatives such as SPC and JIT. These innovations can have as great an impact on job positions as equipment technology. According to the CAW Technology Survey the loss of job positions and the introduction of any new technology are closely related.

- 78% of plants with robots report job displacement.
- 72% of plants with other computer-based equipment report job displacement.
- 83% of those with an Automated Material Handling System (AMHS) report job displacement.
- 64% of those with Just-In-Time report displacement.
- 55% of those with SPC report job displacement.
- 62% of those with QTD report job displacement.
- 91% of those with Computer Assisted Design (CAD) report job displacement.

These figures do not express direct relationships between a particular technology and its impact because



Chrysler Canada

Automated welding line.

in most plants different technologies are used simultaneously. Indeed what is striking about the group of companies which have experienced a loss of job positions is the breadth of technology they have in place. Locals that report technological displacement are generally in plants which use a number of different technologies. Furthermore, the likelihood of displacing labour is greater when a sequence of production and related operations are automated than with stand-alone applications. The more extensive the system application — where different technologies are integrated, such as a robot loading an automated press, and where different levels of production are integrated — the greater the potential for job displacement.

VULNERABLE JOBS

The type of jobs and the job classifications most vulnerable to technological displacement vary with the choice of equipment, the tasks and the context of production. While management is fond of explaining that it is the dangerous, hard and dirty jobs which are the targets of automation, the process rarely ends there. The jobs which are vulnerable to technological change are a function of the ease of automation, the cost of new technology and the anticipated benefits of automation. Typical of automation are the following situations:

1) Simple and Repetitive Jobs

Generally speaking, the more repetitive the job and the less complex the tasks, the greater the chance of it being automated. If a worker spends the shift loading identical parts onto the same fixtures on the line, that job is a candidate for automation. If there are a number of workers doing the same job the probability of automation increases. As a member of management at Ford Glass put it: "Any time you have repetitive jobs being done on a three shift basis by a lot of people, it's a prime candidate for automation."

2) Cost and Consistency

If automation can increase the operating efficiency of a particular task, either by increasing output, reducing costs or by producing more consistent results, chances are the worker previously performing that job will be displaced. This is the case for many welding operations in parts and assembly plants.

3) Management Control

Management see's in automation a means of gaining more control over the production process. As such the more sensitive or critical the operation, the greater the likelihood of automation. Auto companies, for instance, have spent hundreds of millions automating paint shops in assembly plants. An automobile can go all the way from white metal to a finished product, containing thousands of dollars worth of parts, labour and components; it can run at 100%, but a scratch in the finish can mean the car won't sell.

4) Management Vulnerability

Similarly, the more dependent management is on a particular operation or group of workers, or the more problems they have with an area or group of workers, the more effort management will expend to automate those jobs. Production is only as fast as its slowest link; managements' control is only effective if the operation is running.

New technology does not only eliminate dirty, dangerous jobs:

- One third of the survey sample indicated that new technology had either eliminated or improved "unpopular" jobs in their plants.
- On the other hand, almost one quarter of the sample reported that new technology had eliminated "popular" jobs.

CASE STUDY

- "In our paint shop we have something called environmental relief. This is something that we've been — I hate to use the word — 'fighting' with the union over, year after year after year. It's a big conflict. It's a big sore spot in terms of management because here we have a booth — a spray facility — that is technologically one of the most advanced in the world. It's got air movement, glass walls, all the protective devices in it, and yet because we have an agreement with the union to provide this environmental relief, the guy that works there gets 20 minutes of relief every two hours . . . it's hard to justify.

  So one of the ways we're getting around that now is that we're forced to come up with more and more robots. So our long range strategy is that if we can't be competitive with the union by coming up with some relief practices and some daily operating practices that allow us to compete, then the only recourse we have is to go in and put robots in the booth . . .

  We started off using technology when we thought it was in the best interests of the plant to do it. It has now reached the point, 4 or 5 years later, where we're introducing more and more technology as a reaction to some of the things that are happening around us. In other words, we end up with a problem, we end up not being competitive in this area, we end up with a battle here, and our side of the house has tended to look at it this way: 'Is there any way we can mechanize it or robotize it, or put some new technology in, to get rid of the problem?' "

Chrysler, management

Production Jobs

The broad category of direct production workers contains the bulk of job classifications most directly vulnerable to technological displacement. Welders and painters were displaced by the first wave of robots. Now jobs involved with loading and unloading machines and fixtures on the line, and an increasing number of jobs involving assembly operations, are being replaced by robots. Press operators are being replaced by automatic transfer equipment and progressive dies; windshield cutters and trim cutters by new computer controlled equipment; machine operators by self-cycling and monitoring machinery.

Management efforts to reduce inventories and to rationalize the flow of material are affecting the number of indirect production jobs and support jobs in warehouses, plants and offices. Material handlers are put at risk when companies install automated material storage, retrieval and handling systems. Related clerical jobs are vulnerable to the computerization of the paper flow. And both categories are affected by procedural changes such as the introduction of Just-in-Time delivery systems. Jobs in inspection and other quality control functions are similarily affected as companies purchase new sensory equipment and when they adopt procedures such as SPC, which transform end-of-line quality inspection into on-line quality assurance. Finally, other off-line jobs, such as sweepers, relief and utility repair, are vulnerable to management efforts to reduce costs and to establish new work arrangements, such as work teams or cells. These latter developments, while not new technology in the strictest sense, are an important aspect of the new configuration of work.

- At Local 240-Ford, keypunch operators, follow-up clerks and specifications clerks were displaced by new technology.
- At UAP in Quebec City, five workers were displaced when the company computerized its inventory system.
- At IPA in Quebec, the introduction of direct computer links between the retail operations and the warehouse reduced the need for order clerks.
- At Van Dresser the role of line inspectors was absorbed by work teams.
- At Bendix Safety Retraint 'shippers' were displaced as a result of Just-In-Time.

Skilled Trades

Generally speaking, skilled trade workers are less threatened by technological displacement than are workers in other production classifications. In fact, in many plants the ratio of skilled to other jobs has been increasing. Many

CASE STUDY

- "They call it a CNC work centre. It's got anywhere from 10-18 different stations on it. It does the work that we have four or five guys doing now."
- "We make brand new cutting tools. We have two CNC lathes right now. We do a lot of repetitive business with big customers like GM or Hayes-Dana. We used to have 6-8 lathe men who worked on individual jobs and now we have two CNCs and two guys — one on days and one on afternoons — and they turn out the same amount of jobs as we did before. It eliminates people and it cuts down on time."
- "All that CNC equipment means to us is less people. We make industrial cutting tools, which are a skilled trades job, but when you've got a CNC machine that can make 10 tools twice as fast as it takes us by hand, then we lose jobs. They got a $2 million machine that replaced 8 guys three years ago."
- "When you have someone 17 or 18 years old sitting in an office and keypunching and you've got a machine that's a mile and a half away and it is doing the job that is being keypunched . . . Well, it's amazing to see. Makes you think that somewhere down the line machinists are going to be a dying breed."

Tool and Die Roundtable, workers

skilled workers will see their jobs change as a result of new technology, but relatively few will be displaced in the sense that production workers are displaced. Nonetheless, specific groups within the skilled trades, and specific trade workers in particular plants, will be displaced. Managements' success in contracting out the maintenance and repair of new equipment, for instance, will have an impact on the number of skilled trades. The introduction of new CNC metal working machinery is already having an impact on skilled machinists in tool and die shops and other tooling and machining operations.

THE TECHNOLOGY DILEMMA

New technology poses a dilemma for workers. On the one hand they recognize the relationship between technology, productivity and competitive survival. On the other hand they face the prospect of technological displacement or layoff. The distinction between the job eliminating and the job securing effects of new technology often gets blurred. Workers in small dependent companies see technology as a requirement of doing business with the auto majors. Without new technology they fear their employers' will be one of the victims of efforts to reduce the number of suppliers. Workers in larger parts plants see in technology an opportunity to secure 'new contracts' and 'new jobs'. Successful bidding implies new technology. Even though a contract might have required twenty workers before automation, and only five jobs after automation, those five are seen as 'new' jobs, especially if it means an addition to the present workforce.

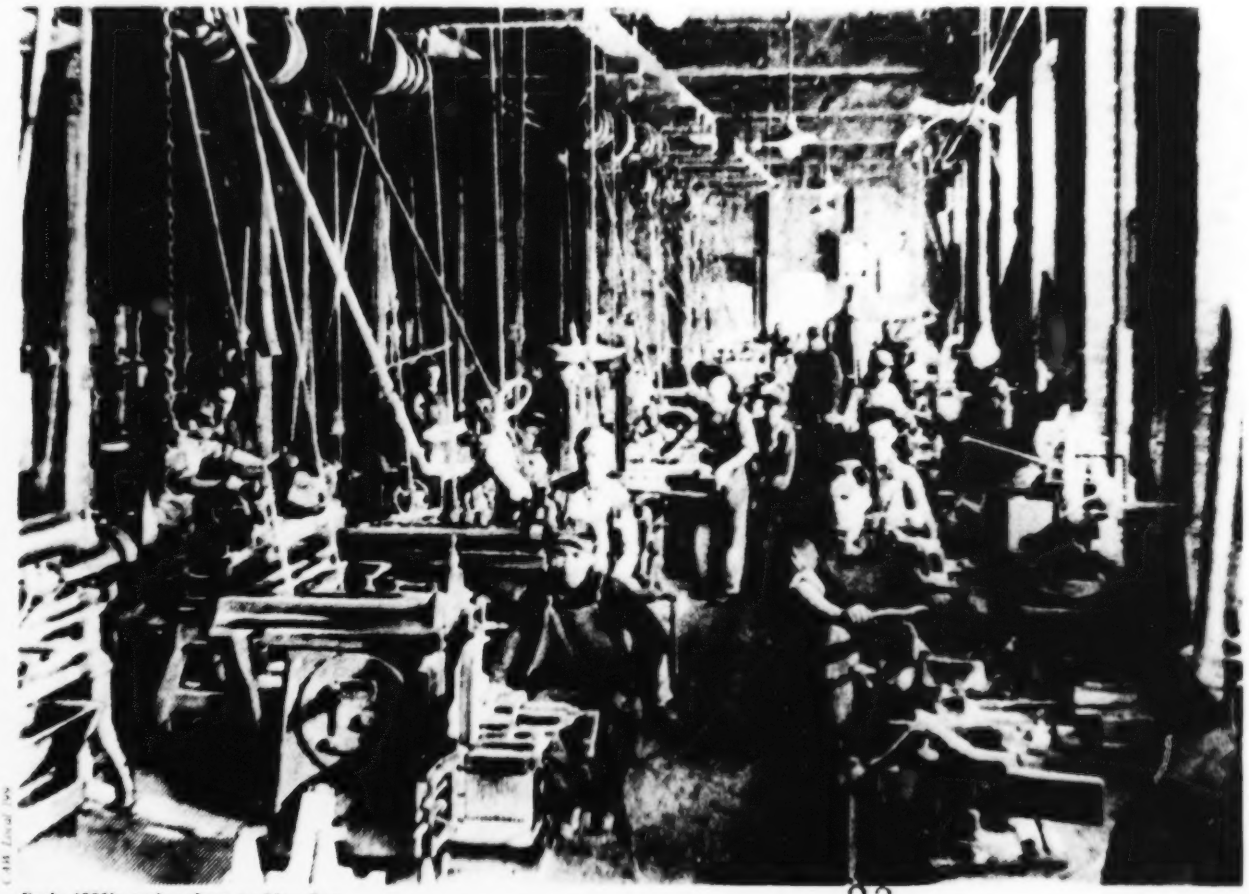
Workers in large assembly plants understand the equation between investment and commitment, and new technology is investment. For some workers the threat of being left out of technological developments is worse than its anticipated impact. For other workers it is better to have technology and fewer jobs than to face the prospect of no jobs at all.

- After being on the ropes for months without a commitment from GM, the workers at Boisebriand were relieved to get the new investment, even though the automated paint shop, the robots and the new work rules might displace some workers. When the alternative is a plant closing, investment in new technology looks like a way of saving jobs, not losing them.

  Quebec Roundtable

- "The thing is that if you go on tours to other plants you see new technology, and if you see it in other plants you don't want your plant to get behind."

  Budd Canada Case Study, worker



Early 1900's engine plant machine shop.

- "We certainly hope that the company is looking into new technology. You hope you're not going down the tubes because you're not getting into it. Progress is going with the new technology."

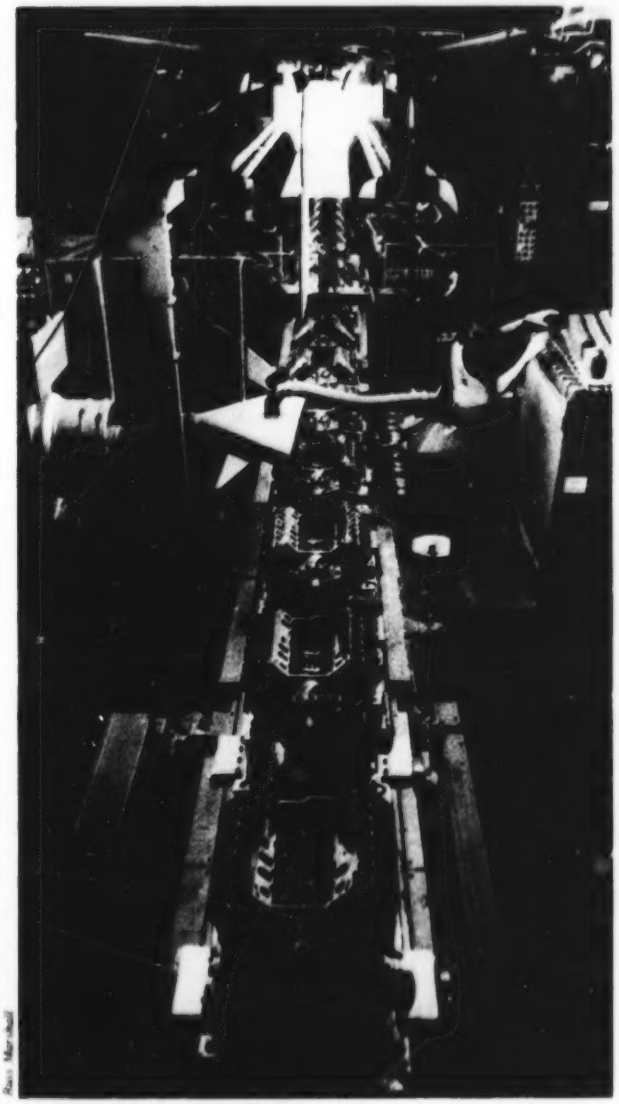
Tool and Die Roundtable, worker

OTHER PRESSURES

New technology is not the only threat to auto jobs. What is especially true in the auto industry is that employment implications cannot be separated from the broader questions of corporate and economic strategy. At times the impact of technology on jobs is overshadowed by other issues. Images of the recession, when plants were closing and thousands were laid off, are still too vivid. Most respondents to the CAW technology survey rank technology as only one of a number of threats to their jobs. Issues such as imports, outsourcing and company efforts to rationalize their operations top the list.

Workplaces that reported technological job reductions have a wider variety of technologies in place than those where no job reductions were reported:

	NUMBER OF DIFFERENT TECHNOLOGIES IN USE		
	0-2	3-5	6 or more
NUMBER OF PLANTS REPORTING JOB REDUCTIONS	9	16	22
NUMBER OF PLANTS WITH NO JOB REDUCTIONS	29	14	3



Modern engine plant assembly line.

It takes a great deal of technology to affect job numbers to the same degree that a 30% import market share does; 326,000 offshore cars being shipped into Canadian dealerships every year accounts for a great many potential jobs. When companies respond to that competition by reducing labour costs through outsourcing — when GM decides to move seat production from an assembly plant to an outside supplier, when Prevost decides to outsource electrical components and fiberglass finishing — jobs are lost. When companies respond by consolidating and rationalizing their operations — when they decide there are too many engine plants, too many stamping plants, too many assembly plants — thousands of jobs are at stake. It takes a lot of robots to even approach the impact of GM's announcement that it will close eleven plants and eliminate the jobs of 29,000 workers in the U.S.

These are not separate issues. Jobs in auto plants are affected by imports, by outsourcing and by technology. Workers are responding to the pressures on their jobs from a number of directions. And even when they feel relatively secure about their present job, they worry about the future; if not for themselves, then for others. There may not have been the layoffs, but neither has there been the new hiring that at other times would have accompanied announcements of new products and expanded production. Everyone is only too aware of the 34,000 people lining up for the 3,000 jobs at the new AMC plant in Bramalea. As one worker expressed it: "Where are my kids going to get a job?"

DISAPPEARING JOBS SUMMARY

- The introduction of new technology is associated with job loss. Technology is designed and implemented to reduce labour costs and the labour content in the final product.
- In the auto industry to date new technoloy has eliminated job positions more often than people. Its impact has been measured more in terms of displacement than layoffs.
- Half the respondents to the Technology Survey reported job losses associated with technological change; relatively few report actual layoffs as a result.
- The impact of technology on jobs has been cushioned by a number of factors, including the general job recovery from the last recession and expanded production in both volume and product mix, in particular plants.
- Most important from a policy perspective, a number of plants have linked the introduction of new technology to the normal rate of attrition. In other words, technology can be introduced without layoffs.
- Technology has been adopted during an economic upswing, a timing that has facilitated the reduction of workforces through attrition. But there is no guarantee companies will continue to use an attrition-based strategy.
- Since the introduction of technology and its pace of adoption appear to be accelerating, the prospects of layoffs could increase in the medium term.
- There is every likelihood that new technology will make future economic growth in the industry jobless or even job destroying. In this sense the impact on job numbers has been postponed to the future.
- Whenever any type of new technology is introduced there is a strong possibility of a reduction in the number of jobs associated with that operation.
- Companies that report job loss/displacement generally have a greater breadth and depth of technology in place. Evidence from the Technology Survey confirms this.
- The possibilities for displacing labour are greater with system-wide applications than with straightforward and limited task-substitution technology.
- Although most workers are affected by technological change, particular groups of workers in particular operations seem to be more vulnerable, both in displacement and potential lay-off terms.
- As a general rule, direct production workers are more vulnerable than skilled trade workers; certain skilled trades classifications are more vulnerable than others, i.e. machinists compared to electricians; displacement and lay-offs extend to indirect and off-line jobs such as inspection, material handling and clerical operations.
- As a general trend the number of direct production jobs will fall; the proportion of indirect and off-line jobs will decrease; the ratio of skilled to production jobs will increase.
- The eventual outcome of technological change on job numbers is not determined solely by the equipment; much depends on organizational factors, corporate strategy and worker reaction. The timing and means of implementation can be as important as the technology itself.
- Technological change is accompanied by a great deal of job and employment insecurity. While workers see a need to respond to competitive pressures, they argue for a balance between new technology and employment security.
- Over 50% of plants in the sample reported job tasks or duties normally performed by production workers had been partially or completely automated.
- 33% of plants reported material handling and other off-line tasks had been partially or completely automated.
- 15% of plants reported skilled skilled trade duties had been partially or completely automated by new technology.
- 70% of offices in the sample reported tasks normally performed by members had been automated.

TECHNOLOGY AND THE TRANSFORMATION OF WORK

Cloth draped spray painting robots.

TECHNOLOGY AND CONTROL

Changes in technology generally precipitate changes in the organization of work. Job design, job content, patterns of work, relations of work are all part of the process of technological change. While the most compelling impact of new technology might be on job numbers, an equally important consideration is its effect on how jobs are done. Some jobs are displaced by new technology, and some are lost, but those jobs that remain are often much different than those which preceded them.

Change is a predictable outcome of new technology but the outcome of change is not. The effects of technological change are not predetermined, nor are they uniform. There is a great variety of computer-based technology and a great variety of contexts. The impact of robots, for instance, may be different from the impact of CNCs, and the impacts of both may vary from site to site and plant to plant. The outcome of technological change in any specific situation is a product not only of the design of technology but also its implementation. Both technical capabilities and social forces shape workforce outcomes.

While there is no simple cause-effect relationship between the potential of new technology to transform work and the final shape of the workplace, technology can potentiate trends. In Canadian industrial culture one of the most clearly discernible trends is the drive for increased managerial control. New technology is designed to increase management's command over production and managerial authority over producers.

Management control takes a number of forms. At times it gets expressed in terms of efficiency, quality improvements, scrap reductions, cost control, absentee reductions, and similar matters. But whether it is SPC and quality assurance, JIT and the predictable flow of parts, robots never on the AWOL list, machines that are programmed in the front office, or sixty-minute work hours, technological change implies more effective management control over workplace activities.

At times technology simply adds to the realm of what is controllable without changing the overall balance of power in the workplace. At CanFab, for example, the introduction of computerized layout and cutting technology provided management a means of assessing the cost of scrap material and a way of reducing those costs.

Similarily, part of what distinguishes new technology from the automation of the fifties and sixties in engine plants is information. Management expresses control in terms of the flow of data and the opportunities which that provides to make the production process more visible to middle and upper management.

CASE STUDY

- Not only does the software allow the programmer to rearrange the patterns, it will calculate the material utilization rate for each configuration. One of the prime responsibilities of the programmer is to get the most cuts from the material and by so doing to reduce the cost and amount of waste . . . "One of the big reasons for the Gerber," explains one management official "is it provided chances to make material savings. Material is an easy one to walk away from, lots of time you just don't get involved with the cost of material, but at $15-$18 a yard it represents significant savings."

CanFab

CASE STUDY

- At the Niagara Glass plant a struggle is waged around the pace of work. Very simply stated, management tries to increase output while workers resist. On the conventional cutting lines workers have an informal quota system. When that 'quota' is achieved, production stops. The people on the line know they can carve out some time of their own.

  What management has, since the days of Frederick Taylor, called soldiering is really an expression of the power relations on the shop floor. At Niagara workers have won some degree of control over production. They know it and management knows it. Management also knows if it pushes too hard to increase production it will have an inverse effect.

  On the new technology line the balance of power has shifted. Management has found a way of resolving the issue in its favour without waging a fight. 'They know how many free hours you can come up with,' explains one worker. 'If your count is 1,000 they say they'd like 1,100. We say we can only produce 1,000. They ask for more and we say we can't produce more and they say, 'fine,' and they end up bringing in the automation.'

  Unlike the conventional line, operators on the new line cannot leave the line before the end of shift; they can't work faster and harder at the beginning of the shift and slow down later on in the shift; they don't control how many windshields they cut or even the quality of the cuts. The speed of the line is determined by management and set by management, the robots are programmed by management, NC tapes are coded by management, the controller is programmed by management and the control panels can only be entered by management.

Ford Glass

- "There is more computer monitoring of our processes, more transmittal of information, more feedback during production . . . We have sophisticated information processing and control mechanisms . . . We are more aware of what is going on and we understand what we're doing more . . ."

Engine Plant Case Study, management

At other times increased management control implies a shift in power from the 'shop floor' to the front office. Among the benefits management attributes to the new AGV system at the GM Oshawa Truck Plant is the ability to better regulate work time. As one manager expressed it: "Jobs, time-wise, will be tighter . . . it will get us back to eight hours work for eight hours pay."

Similarily, with the introduction of computerized technology on the windshield cutting line at the Ford glass plant, management gained more control over production volume and quality. By so doing management effectively limited one element of control traditionally exercised by workers.

It is difficult to generalize about the impact of technology, but not so difficult to ascribe intent. Management controls the design and implementation of technology. Central to both processes is management's efforts to gain more effective control over shop floor activities — over production and over producers. In general terms management wants the process of production to be less reliant on human input and it wants the human input that remains to be, in management terms, more reliable.

Production has always been about control. New technology doesn't change that, but it can alter its terms. For instance, when asked whether technological change had aided management in gaining more control of production, 82% of the respondents to the CAW Technology Survey answered in the affirmative.

WORKING WITH NEW TECHNOLOGY

While the introduction of new technology can be the occasion for redesigning jobs and changing work methods, the technology itself will not determine these changes. The extent and the nature of the changes are dependent on a great many factors: on the equipment, on the implementation process, on labour-management relations, on the attitudes and skills of the workforce, and on the goals and objectives of management. At times established patterns of work are changed throughout a production facility, such as at GM Oshawa. At other times there are only pockets of change where new equipment, processes and work methods co-exist with traditional ones.

While the outcomes of technological change is often situation-specific, it is still possible to make some general observations:

1) The prevailing trends are contradictory. In some situations technological change continues the trend toward increased job fragmentation, deskilling, machine pacing and a rigid division of labour. In other situations changes in the direction of broader jobs, upgraded skills and more interesting and satisfying work have accompanied the introduction of technology.

2) Rarely is technology introduced in ways that consider its social impact. The repercussions of technological change on the workforce are subordinated to management's efforts to increase production efficiency. When outcomes are positive, in terms of working conditions, they are often accidental by-products of technological change, or else they are necessary prerequisites to the successful implementation of the new technology.

3) The production process is becoming more complex. With this complexity comes **a greater range of options and choices.** Technological change has destabilized production; in that instability there are possibilities as well as limits.

The results of technological change may vary, but the issues do not. While outcomes are unpredictable there remains a set of common and emerging themes. Technological change alters the structure of work. As such it has an impact on skill, the scope of jobs, the pace and rhythm of production, relations with peers and on general working conditions.

Skilling vs Deskilling

The issue of skill is by no means a straightforward one. The impact of technology on skills is ambiguous because 'technology' is often less a determinant of skill than are other mediating factors. The way in which work is organized and the way jobs are designed will determine the skills necessary for a particular job as well as the overall level of skills required in the workplace. Furthermore, the way in which technology is implemented and the way tasks are assigned will determine the direction of the shift in skills.

There are three elements in the skill equation: the level of skill, the direction of change in skill and the resulting configuration of tasks, skill and people. All three have a great deal to do with management discretion. Technological change provides managers an opportunity to allocate work in ways that either raise or lower the skill requirements of jobs. The eventual skill outcome is, as such, a product of the particular technology, the job assignment and the prior skills of the worker.

An examination of skill changes in auto plants prompts the following observations:

- There is a general upward shift in skill requirements, a trend that could be described as 'reskilling'.
- Behind that general trend are specific situations where work has been deskilled.

Reskilling

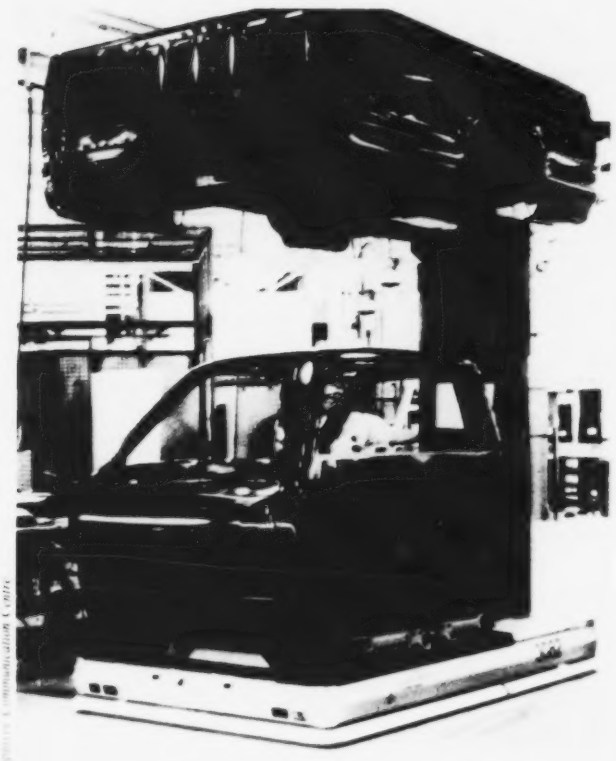
Reskilling refers to the transformation of skills that accompanies technological change. In particular jobs it can mean an upgrading, in the traditional sense, of technical skills. In a broader sense it refers to a shift in skills toward the abstract and code-mediated. And it refers to the changing job composition in the workplace; the shift toward a higher proportion of semi-skilled and skilled jobs.

Technological change environments are turbulent. Workers' skills and the skills associated with particular tasks and jobs are rapidly changing. Old skills become obsolete and new ones are expected. This process of breakdown and renewal can lead to a general reskilling of the workforce, especially when the new requirements are more demanding and the new tasks more complex than what preceded them. Respondents to the CAW Technology Survey overwhelmingly associated technological change with new skill demands. An increase in skill requirements was reported in all of the job classifications considered to be the most affected by new technology. This was true for the skilled trade groups and for production classifications. Part of the explanation for that response can be found in the degree of change that is taking place; part of it can be found in the direction of the change.

Technology requires new and different skills. In general terms that has meant more emphasis on basic academic skills and on analytic skills. For particular groups of workers it has also meant a shift in the technical requirements of the job or trade.

1) Academic Skills. The importance of academic skills gets expressed as demands for academic qualifications, either as a precondition to employment or as a requirement for posting into new technology jobs. When AMC announced that it was hiring for its new Brampton facility, a grade 12 diploma was required of all applicants. When CanFab posted the 'Gerber operator' job positions management made it clear that it wanted candidates to have completed grade 12. The basic functional skills associated with academic qualifications, such as reading, mathematics and verbal ability, are to the computer-based workplace what basic motor skills and manual dexterity were to the mechanically-based workplace.

2) Analytic Skills. The analytic skills associated with technological change have a number of characteristics. In



Automatic Guided Vehicle (AGV) transporting truck cab and box.

automated work sites workers are increasingly involved with the manipulation and interpretation of symbols rather than the manipulation of things. In this sense the task content of work is becoming more abstract. Conceptual skills are becoming more important than motor skills as workers are more involved in monitoring and maintaining systems than with actually operating them. Even basic machine programming requires what amounts to learning elements of a new language. In addition, specific programs being initiated by companies — like SPC — require familiarity with statistical constructs and the ability to interpret data. As work activity shifts from 'doing' to 'monitoring' there is a parallel shift in skill from the former 'tricks of the trade' to more analytic problem identification and solution skills; from 'on the job' experience to cognitive learning.

As systems become more and more complex the price of failure, error or breakdown becomes more costly, more disruptive and less tolerable. In such a context management's desire for reducing skills is tempered by their need to make workers more responsible for production. While initiative and judgment are not constant needs, they are more important at those times when they are required. These general shifts are evident in jobs and workplaces throughout the industry.

3) Technical Skills. The change in technical skills is best illustrated by an example; in this case by electricians. In the CAW Technology Survey electricians were singled out as the trade most affected by technological change, and the responses were unanimous in pointing to an increase in skill requirements associated with the job. While it may not be true in all instances, as a general trend the maintenance and repair of new computer-based equipment has increased the skill levels of electricians. Electricians are now dealing with electronics, programming language and programmable logic controls in addition to electrical hard wiring, cams and relays.

Reading tape on NC windshield cutting line.

While the new technology requires new skills, there is no guarantee that those who are currently electricians will own those skills, nor are there any guarantees that these new skills will be more than 'transistory' skills. Throughout the industry electricians are gaining new skills, but at the same time management is attempting to determine access to those skills and, increasingly, new equipment is being designed to reduce the level of skills necessary to diagnose and repair problems.

Deskilling

The impact of technology on skill is not uniformly one of upgrading. Many workers have found their skills depressed by new technology. A job can be deskilled by breaking a complex job into a series of specialized tasks and by standardizing operations so that the job requires either less judgment and initiative, or can be performed by a worker with less skills. Deskilling in the auto industry is often a substitutive process: tasks formerly done by a person are allocated to a machine; tasks formerly requiring the skilled trades are performed by workers in a different classification.

One of the most frequent instances of deskilling occurs with the introduction of CNC machines in small metalworking shops. In many cases journeymen machinists and toolmakers have been replaced by machine operators. Even in those situations where machinists have remained, their jobs have been eroded and their skills depressed.

There are times when CNCs do not lead to a depression of skills. Some workers believe that skilled machinists can work with the new CNC technology and not be deskilled.

- "On a CNC it takes as much of a machinist to use the machine, plus the adaptability to be able to control it with the computer, so in actual fact I think it requires more skill to operate CNC machines . . . The intelligence level has to be higher now because you also

CASE STUDY

- "The guy they brought in for the CNC machine had no tool experience — he couldn't even read a set of mics . . . Now we've got two more people on CNCs and those guys can't even read mics. They got hired in at $8 an hour . . . They just put the tape in and sit and watch the machine . . . they couldn't work anywhere else in the shop."
- "You won't even need a man to monitor it, the machines will monitor themselves. They've got all these electronic scans that tell when the tool edge is wearing, what horsepower the machine's using. They've got all these tool change systems, so they can change tools whenever they want, so you don't even need a man there."
- "Our guys are looking for jobs elsewhere because they are so bored. They took the job because they thought it would be CNC and computers and all that — you know, challenging — but they were just standing there."

Tool and Die Roundtable, workers

have to learn how to operate the computer. Before it was just the manual operations of the machine."

- "When someone came into the trades in the 1930's, 40's or 50's, when he came into the shop as an apprentice the first thing he had to do was square up a block with a file. Now if you take the file away from the guy and give him a mill and a vice to square up that block, are you deskilling that guy? That's progress and you move ahead that way. Today you sure don't see anybody squaring up blocks with a file — the guy has become skillful at running the mill . . . Now maybe you'll go to something else (CNC) and the mill is going to be left behind . . . Skills are going to be in a different direction."

Tool and Die Roundtable, workers

While the introduction of CNC's has actually depressed the level of skill needed to 'operate' a machine it need not deskill the machinist. This will be the case if a machinist is not replaced by a machine operator and if, in addition to metalworking skills, the machinist begins to acquire and use the skills associated with programming the machinery and editing the programs. Although the possibility exists for such skill upgrading, the evidence from actual experience with CNC's points overwhelmingly in the opposite direction.

Deskilling is not restricted to machinists and tool makers. In other trades management may not have the opportunity to substitute less-skilled workers for higher skilled workers, but technology still affects both the depth and breadth of skills required.

- In the repair garages of International Elite Trucks and of Western Star, licensed mechanics complain that new technology has deskilled their work. The new automated testing equipment has reduced the need for their diagnostic skills, and the new pull-out and replace components render their skills of repair much less important than they were in the past.

Quebec Roundtable

Job Enlargement vs Job Fragmentation

In auto plants the legacy of Frederick Taylor remains strong. Jobs, particularly those on assembly lines, are characterized by fragmented and repetitive tasks, the hallmark of Taylor's Scientific Management. Taylor provided employers a corollary in the organization of work to Henry Ford's moving assembly line organization of production. And generations of Scientific Managers, with their time and motion studies and their unbridled effort to standardize all tasks, have successfully transformed work into simple labour. Factory jobs became a package of tasks that management could control, arrange and assign in a way that reduces workers' judgment and their control over work and the workplace.

That sums up the last ten decades in the history of manufacturing. The transition from early manufacturing to modern production has been a transition from worker-dominated processes to worker dominating machines. Each era in the history of auto production has generated a different configuration of work as changing technologies and changing work methods alter what workers do. The early stages of manufacturing production required skilled craftsmen. Work was characterized by long duration and varied tasks. In the transition to mass production the tasks, although still of long duration, became repetitive and less complex. With the maturation of mass production and mechanization work was transformed into routine, repetitive tasks tied to the short duration cycles of machines. In the current period of transition the relation of work and technology has yet to be determined.

STATEMENT	PERCENTAGE OF RESPONDENTS WHO AGREE	DISAGREE
a) Today workers have more control over their work than before.	45%	52%
b) Today workers have more freedom than before.	31%	67%
c) Today workers are faced with more stress on the job than before.	84%	15%
d) Today jobs in the plant are more boring than before.	39%	56%
e) Today workers have a much broader range of responsibility than they used to.	81%	16%

New technology has the potential to reinforce existing patterns or to disrupt them. New technology jobs can be better jobs. They can be broader, more varied, more interesting and less machine paced. On the other hand jobs can deteriorate. New technology can lead to an intensification of work and an erosion in the quality of life on the line. In the auto industry both trends are apparent.

Broader Jobs

Assembly line workers are critical of assembly-line jobs. As a veteran engine plant worker expressed it:

> "Your brain gets slow. It doesn't function the way it should. You do the same thing day in and day out and your brain goes. I'm like a robot. I walk straight to my job and do what I have to do."

For some of those workers technological change has meant that work is different now. The introduction of new technology has seen a number of jobs broadened and its has invested them with greater responsibility. One worker on a new technology line expressed it this way: "On the conventional line I was the robot. Now I have responsibility."

There is an overall reduction in the proportion of

simple, repetitive tasks in workplaces today. Proponents of new technology see this as a natural outcome of technological change. And management describes these changes as if they were the goal of technology; as if the traditional design of jobs was an accidental outcome of prior production methods.

> • "We can take out of the process a lot of boring, non-thinking jobs that are demeaning but that our people are working at because they have always worked at, and somebody's got to get that pieces from here to there. It's not a thinking job whatsoever. The minds that are involved, I think, atrophy after awhile. They've got to go dead when you do the same thing 5,000 times a day."
>
> Ford Glass Case Study, management

CASE STUDY

- The NC attendants are no longer physically tied to the machine. They are free to sit, stand, walk around. They can move up and down the line. They can move their bodies in ways which are not dictated by the speed of production and in ways fundamentally different than the simple repetitive demands of the conventional line. They are not "stuck in that goddamn three foot circle of the conventional line." The work area has become the whole line, not just one machine or one task.

  On the NC line workers have more say over how they will do their job than is generally the case in the plant . . . and job rotation has eliminated most of the tedium . . . Furthermore, the informal control of work routine makes work more responsive to the changing needs of the operators . . .

  The men on the NC line perform a variety of tasks. They have become generalists. The new jobs involve parts of the old jobs, some tasks formerly performed by the skilled trades and some completely new requirements . . . In a sense, albeit limited, the process of production has been put back together.

  Ford Glass

- The jobs of the Gerber operators are definitely broader jobs than most other jobs in the plant. They are enlarged and enriched. Enlarged in the sense that there is a larger number of tasks built into the job, thereby extending the work cycle; enriched in the sense that operators have more responsibility for planning and organizing their work.

  The women on the line consider their new jobs better than other jobs. The job content is more varied and the job rotation keeps it interesting. "There is always new things, you're always learning," explains one worker. "It's a really interesting job," concludes another.

  CanFab

The opportunity of 'taking out of the process' the routinized, repetitive jobs has often meant eliminating them rather than changing them. But those jobs that remain are considered by those who work with the new technology to be better jobs. In general, workers describe the new jobs as more 'satisfying', 'interesting' and 'stimulating'. They talk about the jobs as being 'less physical and more mental' and about a new sense of 'importance'.

Work Intensified

New technology can expand the scope and content of work and it can lengthen the work cycle. On the other hand, new technology can be introduced and the new jobs can end up looking like the old ones. Furthermore, opportunities for broadening jobs can be turned into work intensification efforts. If a job that typically requires a single task is broadened to include a range of tasks, the job is usually considered improved. Similarily, longer work cycles are considered to be more satisfying than short cycles. But if the tasks are all very similar and if the length of time to accomplish them is inadequate, the job has not really been broadened at all. Lengthening a job cycle from 16 seconds to two minutes may seem an improvement, but when it is realized that the two minute job is a package of twenty, nine-second tasks that should really take 2.5 minutes, that assessment changes. The line between broadened jobs and more work is a critical one.

Furthermore, the capital intensity of the new technology has led to the introduction or the extension of more 'intensive' forms of work, such as shift work and multi-shift operations. At CanFab, Gerber operators are on shift-work, but not so the rest of the cutting department. At Ford Glass the NC attendants are on a two shift schedule while other departments are only on days. At Kenworth Truck the automation of the warehouse caused a shift in jobs from days to afternoons; workers with high seniority found themselves facing evening work.

Boredom vs. Stress

The proposition that stress levels in the workplace have increased with technological change is a convincing one. Among respondents to the CAW Technology Survey there is overwhelming support for the observation that stress levels on jobs affected by new technology have increased. This is true for the skilled trades and it is true for jobs in other production classifications. It is also the case that many of the jobs affected by new technology are considered to be more boring.

It *is* possible for jobs to be both boring and stressful. New computer-based equipment is designed to operate with minimal human intervention. When it runs smoothly there is little to do. Much of the time the job is just watching and waiting and watching. But that in itself is stressful. Long periods of monotony are their own source of stress. The relationship between boredom and stress is expressed by one skilled machinist who works on a CNC:

> "There's less fatigue on the CNC — physical fatigue I mean. It's not strenuous, but there is more mental fatigue. It's mentally harder because you're not involved. You have no choice, the machine decides."

A worker who monitors an automated line comments that: "There's nothing worse than a line that's running perfect. It's a boring job."

But then there is the pressure when something goes wrong. Workers are monitoring complex and expensive systems. Equipment is expensive, downtime is costly and the pressure to keep it running is tremendous. Although workers are nominally responsible, there is often little they can do when the system goes down, except worry. Stress is common in situtations of high demand and restricted job control. Furthermore those who are charged with maintaining and repairing the equipment also find that work has become more stressful.

> • "We keep this thing running. Some days its smooth, other days its a nightmare. I had cramps in my legs last Saturday from chasing after is so much."
>
> Chrysler Case Study, worker

Machine vs. Self Pacing

There is often an explicit tradeoff with new technology. While technology provides management more control over the pace of production, it also can release workers from the rhythm of the line. In auto plants popular jobs are, as a rule, off-line jobs — the jobs in inspection, relief, QC, some material handling jobs, as well as jobs in off-the-line sub-assembly. If a machine isn't pacing you — be it a press that cycles every 20 seconds, a conveyor that carries 150 engines every hour past a work station, or a drag chain which pulls along 1,070 cars a day — work is considered to be more attractive and the job is considered to be a better one.

New technology has freed jobs from the line. A worker who used to insert valves in engine heads now watches a robot do it; a worker who used to cut glass now monitors an automated windshield cutting line; a worker who used to manually cut cloth now monitors a laser.

But while technology has freed some jobs from the line, it has left others much the same as they were.

> • Jobs on the new automated lines in the press shop and in the assembly area are just as repetitive and routine. The pace of work is determined by the speed of the line. The press operator on line 11 loads a blank at one end of the line and someone else unloads it at the other end of the line. Assemblymen on the C&H Rail lines either load parts, transfer them from one resistance welding line to another, or unload them. These jobs have not been expanded in terms of responsibility or upgraded in content. They do not give workers more satisfaction or autonomy.
>
> Budd Canada Case Study

More troubling still, new technology has tied jobs to the line that were otherwise free of it. Many of the technical and organizational initiatives in the auto sector are directed at making and keeping production as continuous as possible. Management would be only too happy if it could make cars the way they make polyester. In auto a more efficient flow of production has meant imposing the pace of the assembly line onto sub-assembly jobs. As a

CASE STUDY

• According to management the technological renovation of the truck plant has broken the assembly line process and has released workers for more varied, interesting and satisfying work. With the introduction of work islands and AGVs a worker will no longer have to repeat the same task over and over on every truck that passes by on the line.

According to management the worker will now control the timing of the job because the AGV will remain at that spur until it is released by the worker. The worker will perform a variety of tasks and each different truck will require different tasks, depending on its option content. The worker will be responsible for minor repairs and will have more responsibility for production — for assuring that the job is done right the first time.

No doubt AGVs represent some improvements over the old line; no doubt the working conditions for many have improved. Initial worker reaction appears to be positive. But not all jobs have improved and, whatever else the contribution of AGVs to improved working conditions, it, at least in its present configuration, has little to do with broadening jobs.

On the hardware line, Island Five, right hand side, is a case in point. The 'sequence build' involves tasks such as: #1, finger start IP nut . . . #2, route and connect heater control cable to heater module (x2) . . . #4, get and route power wires through 'A' pillar . . . #6, assist partner to place and secure IP pivot nut . . .' and so on all the way through to 'item #15, release carrier'. Each of the tasks are timed. The last task, #15, is clocked at .01; #6, which has the longest time, is clocked at .78. Altogether if all 15 tasks are done (it varies depending on options) it's a 4.8 minute job; the average job length, taking account of options, is 2.78 minutes.

Observing Island Five, right hand side, its hard to think of broadened jobs. It's hard to believe that the job could be done in anywhere near the allotted time. On paper a job is straightforward: first you do this and then you do that. In actual practice it is often much different. At Island Five the worker is reaching for bolts. Next he's on his back inside the cab reaching up. Then he's outside at the front bending over and reaching down. Wires are twisted together and shoved in holes, fingers are reaching down through other holes, groping for loose ends and so on, with the clock steadily ticking until the warning light comes on and the AGV is set to go.

This particular job, like all the jobs in the truck plant, is subject to change. Management admits that some of its times are unrealistic and it points out that the plant is still in its initial trial phase. All of which reinforces the basic point: Jobs can be broadened or work can be intensified.

GM Truck

CASE STUDY

- At GM Oshawa the technical transformation of production has involved integrating, by means of the electrified monorail, operations such as the Instrument Panel (IP) Build Up and the door panel sub-assembly into the main flow of production.

  What looked like the 'preferred' jobs to both the union and management have ended up being less attractive in practice than they were on paper. The reason has to do with the pace of work. As one worker who now works in the door line sub-assembly area — originally thought to be a preferred job — expressed it: "I'm bumping out of here as soon as I get the chance. You just don't have enough time to yourself."

  GM Truck

- As its name implies, the 'transporter' is used to transport work. Essentially it is a conveyor used to carry work to and from the sewing machine operators . . . One management official explained its rationale and its impact on the organization of work as follows:

  "It's a beautiful system. And there was an indirect labour savings with it in that you don't need people carrying the work from me to you. We have a person up at the console with the orders waiting. If Mary Jane is out of work her light goes on saying 'I need more work'. The tub goes down to her. It's a smooth orderly way to handle a multitude and complexity of parts.

  It takes away from the fact that — 'If I don't have any work I'll just get up and go visit' or something like that. I guess it forces discipline in the area. If they have to go to the washroom they still can, but as far as idle time due to waiting for work, it eliminates that."

  CanFab

- On the hardware, chassis, and other sections of the AGV system at GM, workers are members of what are called Natural Working Groups. These groups are stationed at a work island consisting of 4 or 5 spurs. The spurs are the locations at which the AGVs stop. At each spur there are two workers, one on the left and one on the right hand side. Workers have the other person on the spur to talk with and they have a broader group of workers with whom they can relate.

  Elsewhere in the plant this isn't the case. On the new door line in the body shop work stations are separated by masses of machinery and workers by volumes of noise. The worker at the first station on the line, the door ring, is physically and visibly separated from everyone else. A relief worker, on that particular job for the first time, captured the sense of isolation when he exclaimed: "I wouldn't want to get hurt here. No one would hear me!"

  GM Truck

result, the principal attraction of off-line jobs — more self pacing — has been removed.

Lack of autonomy is not a new issue on the shop floor, but technology adds to it a new dimension. At times more control for management has actually meant more self pacing for workers. Elsewhere, however, the tradeoffs have been overwhelmingly one-sided.

Isolation vs. Interdependence

On this, as with other issues, there are conflicting results. In some plants the introduction of technology has reinforced the isolating features and alienating effects of the assembly line; in other cases workers have gained more contact with their co-workers. At times both trends are evident in the same plant.

There are two trends. One means jobs which have no opportunity for interaction. This usually happens when automation increases the span between those work stations occupied by workers, or when the noise generated by the machinery effectively precludes discussion. The other trend presumes jobs which require interaction. Throughout the auto industry there is a growing trend toward group or team work. According to the CAW Technology Survey one out of five plants already have some form of team work in place.

In some locations production has been so altered that it is no longer appropriate to think in terms such as 'one person-one job', or 'one worker-one machine'. Instead, it is more appropriate to talk in terms of 'one group-one system'. While the concept of group or team does not denote a particular level of social cohesion, it does suggest more interaction. Whatever else these teams may lead to, they have restored opportunities for social contact.

Safety vs. Hazard

There is general agreement that technological change has resulted in some improvements in the working environment. In plant after plant management stresses the relationship between new technology and a safer, better workplace. When corporate representatives discuss automation they usually begin with their commitment to improving life for those on the line. This is particularly so in the case of robots. The instructors at the Ford Robotics Center in Dearborn Michigan provide a checklist in answer to the question Why Robots? Heading up the list is the statement: "improve working conditions". Throughout the industry the management refrain is the same — robots mean the elimination of dirty, dangerous and unsafe jobs.

By and large robots have removed production workers from close contact with moving parts and hazardous situations: spray painting robots remove workers from paint fumes; welding robots remove workers from flying sparks; material handling robots reduce the need for heavy lifting and awkward bending.

In places automated equipment and systems have led to better physical environments — cleaner, brighter and temperature controlled. The new paint shop at Oshawa, with its airlocks, bright lights, and workers who clean their sections over and over again all day long is one example. The control booth on the heated windshield line at Ford Glass, where it is bright, clean and quiet, is another.

While workers are quick to acknowledge improvements, they point to the hypocricy of companies who care

little for the conditions workers have worked under for years but are quick to respond to the environmental requirements of the new technology.

Workers are also concerned that various forms of technology have both positive and negative consequences; that the way work is organized around the technologies can be detrimental to health and safety.

- in offices, the use of VDTs.
- the trades, working in the cramped conditions of automated systems and working on equipment with which they are unfamiliar, and on which they have not been trained.
- the noise levels associated with some new machinery.
- the complexity and unpredictability of programmed equipment.

THE DESIGN OF JOBS

The variation that is found in new technology jobs relates to the range of technologies that are being installed. But the design of particular jobs depends not only on the choices of technology but on the choices *around* technology. Work on the same or similar equipment and processes can be organized quite differently from location to location and even within the same plant. The same technology can produce a different work organization, with different relationships, different job content, skill levels and even rates of pay. New technology creates options.

New technology might establish the conditions for better jobs, but it doesn't determine the outcome. Similarly, situations of technological change might be conducive to shaping better work environments and working conditions, but the end result is still a matter of management discretion. A job is essentially a set of tasks that can be allocated in different ways. This allocation is not bound by technology. Those who argue that for many workers the quality of life has deteriorated with new technology, and those who argue that technological change has resulted in improvements, are not necessarily arguing about technology, but about outcomes. Again, on issues such as skill, autonomy and control, responsibility, the range of tasks, and many others, the results of technology are mixed. There are very clear trends in both directions.

Beyond fair wages and job security workers want interesting work. They want a clean and a safe workplace. They want some say in how the job is done and some control over the pace at which the job performed. They want to feel good about what they are producing. They want recognition and opportunities in the workplace. They want friendship with their peers and good relations wih their supervisors. They want to be involved.

Some jobs provide more satisfaction than others. Some jobs are considered to be better than others. A reasonable approach to technological change would be to identify desirable jobs, determine what features make them attractive, and then reproduce and expand on those features throughout the workplace.

New technology permits a certain freedom in designing jobs. The introduction of new technology can be an opportunity for altering job content for better or for worse. If the overriding concern with technology is productivity, defined in narrow corporate terms, then the outcome of technological change will be limiting and the opportunities currently present will be foreclosed.

CASE STUDY

- All three trim plants use the Gerber cutting technology. But the organization of work is not the same in all three plants.

At CanFab there are three Gerber Operators who rotate through the three stations of the line. First they spend a week at the automated spreader, then a week at the control console and then a week doing what they call the 'Joe Job'. At Chrysler in Ajax the Gerber is staffed in a similar manner. There are differences, but from a job design perspective the similarities are greater. Not so at GM Trim in Windsor. At GM the differences are more substantive.

On each Gerber at GM there is a job classification of 'Automatic Cutter'. This is the person who is stationed at the control console. The job is fixed — there is no rotation to other stations. This is true for the other jobs on the line. The layout is done manually by the 'layers', who move from machine to machine setting up the jobs. On the other end of the line are the 'pickers', who do nothing but pick the cloth and discard the scrap; the job the CanFab operators termed the 'joe job'. At GM those who operate the console earn about 50 cents an hour more than the pickers.

The jobs on the Gerber at both CanFab and Chrysler would be considered an innovation in job design. They are enlarged and enriched compared to traditional cutting jobs and the rotation makes them, according to the operators, more interesting and less boring. In the absence of the different arrangement of work at GM it would be easy to conclude that the technology of the Gerber calls for a particular organization of work. But it is these differences which demonstrate that job content and the design of work are management prerogatives.

While management is responsible for job design, there is little evidence to indicate that jobs are actually designed to be 'good' jobs. Job rotation/enlargement on the Gerber is not a purposeful innovation. It is simply an attempt to provide management with as much flexibility as possible. At CanFab and Chrysler management needed to train a sufficient number of workers to provide flexibility and some guarantee against production downtime. As one manager explained; "If employees were trained but weren't always using their skills they would quickly become rusty and couldn't fill in." In other words, three operators and job rotation is good contingency planning. GM, on the other hand, doesn't require the same type of flexibility. It has five Gerber machines and enough trained operators to handle contingencies.

CanFab

TECHNOLOGY AND THE TRANSFORMATION OF WORK SUMMARY

- Changes in technology generally precipitate changes in the organization or work: job design, job content, patterns of work and relations at work are all part of the process of technological change.
- The consequences of technological change are a product of the design of technology, the process of implementation, labour/management relations, worker skills and attitudes and management goals and objectives.
- Management currently controls the design and implementation of new technology. Accordingly, it is often used as a means of increasing management's command over production and managerial authority over workers.
- The effects of automation on work are not predetermined, they are not uniform and they are not unidirectional; they can be influenced through a strategy of active participation and involvement in the tech change process.
- The outcome of technological change is generally situation-specific. Rarely is it introduced in ways which take account of its social impacts.
- While the results of technological change may vary, the issues raised are often similar. How does technology affect skill, the quality and design of jobs, boredom and stress, the pace of work, social relations at work and health and safety?
- The impact of new technology on skills is ambiguous. Technology is often less a determinant of skill than other factors, including the way work is organized or the way jobs themselves are designed.
- There is a general trend in auto plants toward an upward shift in skill requirements, best described as reskilling. Respondents to the CAW Technology Survey overwhelmingly associated technological change with new skill demands.
- These new skill demands include a higher premium placed on basic skills, like reading and mathematics, an increasing demand for academic qualifications and more emphasis on analytic and interpersonal skills.
- Behind this general trend of reskilling, however, are specific situations where work has been deskilled. This occurs primarily in certain skilled trade classifications working with particular technologies, such as CNCs.
- New technology has the potential to make jobs broader, more interesting and more varied.
- Opportunities for broadened jobs can also be turned into work intensification efforts. New technology can be used to make work more machine-paced, it often increases shiftwork and it can generally erode the quality of life in the workplace.
- Respondents to the Technology Survey are in agreement that new technology increases the level of stress on the job. It is also the case, however, that many of the jobs affected by new technology are considered to be more boring.
- Many new tech jobs are both boring and stressful. At times there is little for an operator to do except watch and wait; at other times the pressures associated with a breakdown of the equipment are tremendous.
- There is often an explicit tradeoff with new technology: it can provide management more control over the pace of production or it can free workers from the rhythm of the line.
- In the auto industry new technology has freed some jobs from the line and it has tied other jobs that were previously free from the pace of the line directly to it.
- New technology has increased the amount of social contact between workers in some situations; it has increased isolation and alienation in others.
- Some new technology jobs require interaction. The increasing trend in the auto industry toward work teams and work groups reflects this.
- On the other hand new technology results in jobs with no opportunity for interaction, usually because of increased distance between workstations or because the noise generated by machinery precludes discussion.
- Workplaces today are typically cleaner, brighter quieter and of a more consistent temperature than in the past, but exceptions do exist.
- Troubling, however, is that improvements only tend to result either as a by-product of the tech change process or because of the specific environmental requirements of the technology itself, not as a specific policy objective of management.
- The design of particular jobs depends on the choice of technology and on choices made around technology.
- Work on the same or similar equipment and processes can be organized quite differently from location to location. Technology creates options.
- But while technology can establish the conditions for better jobs and improved working conditions, it doesn't determine outcomes. The end result is currently a matter of management discretion, but it need not be.
- If the overriding concern with technology is productivity — in the narrow corporate sense — then its consequences will be limiting. The opportunities currently present will have been foreclosed.

THE NEW MANAGEMENT AGENDA

The introduction of new technology provides management with a chance to strengthen its authority and control. But at the same time, technological change requires a more involved workforce. In the long run the dilemma for management is whether it can secure this involvement without relinquishing control.

Technological change means more than the technical transformation of production. It also means its social transformation. The changes introduced by technology are not confined to the process of production but extend to relations in production. Along with the implementation of new technology come changes in the traditions, norms and values of management. What is emerging is a new — or revised — Managerial Technology.

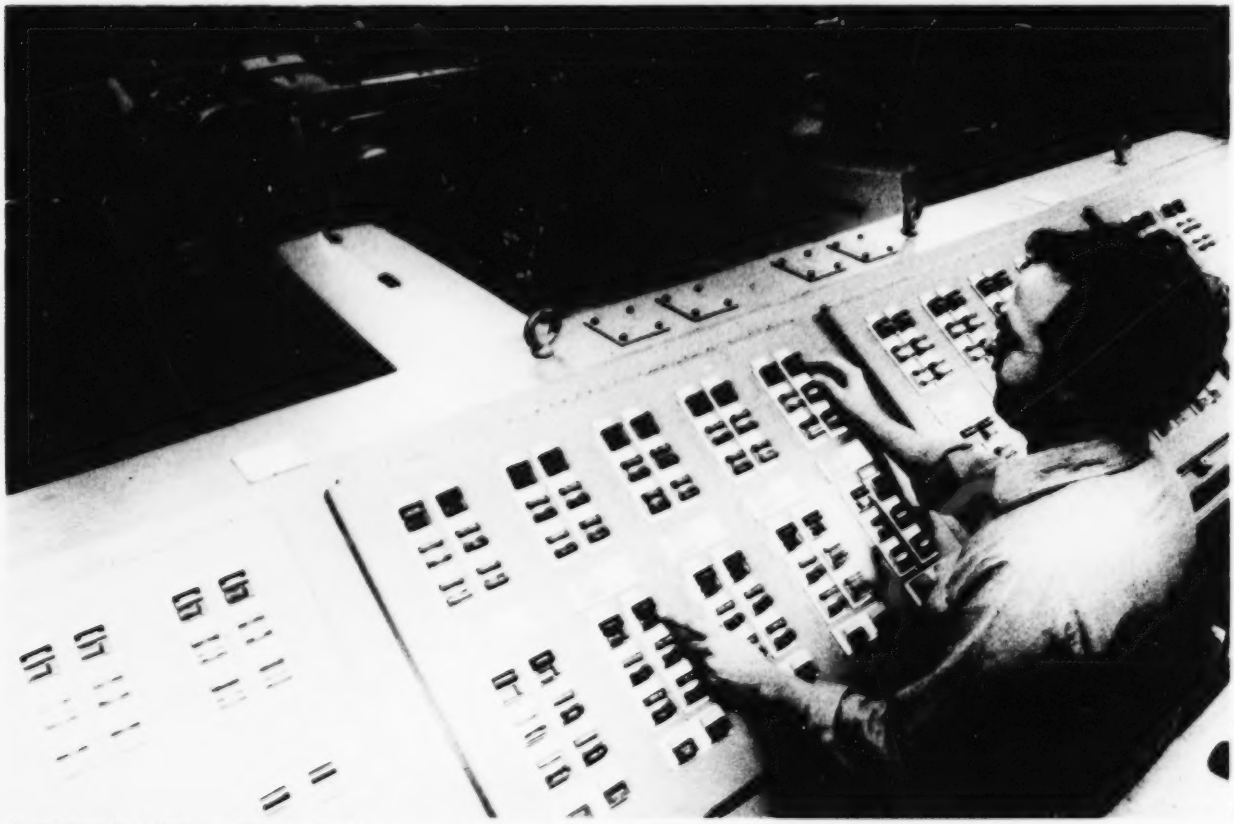
As a general trend the new managerial style represents a change in the philosophy and techniques of workforce management. It is expressed as a transition from the autocratic labour relations approach to a more participatory employee relations approach. The new approach is marked by a shift from formal Labour-Management relations to an informal worker-supervisor relationship; from the workforce to the individual worker and the small group.

These changes are discernible at all levels of the corporation; from the efforts to reshape official 'Human Resource' policy to efforts to improve relations with individual workers. The implementation of the managerial technology usually begins with policy pronouncements from Head Office emphasizing the new employee relations objectives and strategy. The following excerpt, adapted from Ford's *Statement of Mission, Values and Guiding Principles,* is typical of the tone and content of these pronouncements:

- **People:** Our people are the source of our strength. They provide our corporate intelligence and determine our reputation and vitality. Involvement and teamwork are our core values.
- **Employee Involvement is Our Way of Life:** We are a team. We must treat each other with trust and respect.

At the local plant level the policy gets interpreted, translated and implemented in different ways, but local management, regardless of the company, agree that it is the beginning of a new era in labour-management relations.

In the official view new technology is part of a fundamental change in management thinking, a transition which is substituting worker participation for managerial dictate. The key elements of this new style are collaborative efforts and active involvement by all affected groups in the process of change. Throughout the industry new buzzwords and catch phrases abound: 'more openness', 'information sharing', 'trust', and 'teamwork' and the new 'work management' initiatives are quite commonplace. These new initiatives can be found in various forms in virtually every plant: the new 'area management'



Control panel at Chrysler assembly plant #3.

developments at GM Oshawa, the extensive training of front line supervisors at an engine plant, the Human Relations seminars at Budd Canada, or the 'motivational awareness program' at the Chrysler Mini-Van plant.

- "I think probably most important to us is the technology that is related to what we call the new way of doing business. That is the technology inspired by the general workforce being involved. Our business is their business and we're all involved in the same business. That is different from the old style of doing business when there was a few people who ran the business and everybody else worked for them."

Ford Glass Case Study, management

The new managerial technology means enlisting the cooperation of the workforce and fostering a different set of attitudes in the workplace. In so far as 'production' has been rediscovered in corporate boardrooms, so to have workers been rediscovered as a key element in the production process. Management wants its workers to be fully committed and it wants the resources of a skilled, dedicated and highly productive workforce at its command. The task for management is first to overcome worker resistance to new technology and then, even more importantly, to transform compliance into commitment. In this sense worker involvement is becoming a technological prerequisite; the new 'work management' initiatives are designed to encourage and manage this involvement.

While new technology means that production relies on fewer workers, it also means that production relies more on those workers. This reliance takes a variety of forms. Management requires cooperation in installing, debugging and getting new technology equipment and systems operational. Once in place, management relies on workers to trouble shoot and help resolve problems with the new technology. More complex systems have more complex problems. The more productive a system is when it is up, the more costly it is when it is down. General Motors, for instance, in discussing some of the new systems at Oshawa, notes that: "Many of these new machines have as much as a seven minute shutdown time and a seven minute startup time. Every minute of downtime costs money."

Furthermore, management needs access to worker know-how, experience and talent on a continuing basis to achieve the cost, quality and productivity improvements it requires. Finally, management has recognized that the advantage of new technology rests in its flexibility. And management has recognized that one of the criterion of market success has become flexibility. In fact, North American producers are developing what amounts to a production strategy of flexibility: a strategy that requires a flexible workforce and that relies on a flexible deployment of labour.

MANAGEMENT'S NEW PHILOSOPHY

Management's new philosophy is a potent blend of fear and promise; the Japanese Threat and the lessons from Human Relations — a contemporary metamorphisis of the 'carrot and the stick'. In some companies and workplaces there are more carrots and in others a longer stick, but they all share the basic themes. Stripped down it goes like this: First, 'the Japanese have a real competitive edge, both at home and in their new transplants'. Second, 'the gap must be closed or we forfeit our jobs'. Third, 'the goal is to increase quality and productivity'. Fourth, 'workers and management are in this together'. Fifth,' we can do it, but survival depends on new technology, new relations and new ways of doing business'. To this list of standard refrains has recently been added another: 'Workers and their union in the U.S. have faced the facts and are prepared to change. As a result they will get the business.'

The Threat

- "In 1979, we had over 46% of the Canadian car market. In 1985 though, our share had shrunk to just over 35% . . . An eleven per cent loss . . . primarily due to the pressure of imports. That amounts to 120,000 vehicles that we didn't sell, that someone else did . . . that's a total of over 7,000 jobs . . ."

GM Truck, Employee Production Readiness Training Manual

- "The differential is still there. A Japanese company can produce a car for about $1,500 less than a North American company."

Budd Canada, Human Relations Seminar

- "We've made improvements but we've still got a long way to go. We've gone from about 1.4 to 2.26 engines per worker, but Japan has a range of 3.6 to 4.0 engines per worker for a comparable engine."

Engine Plant Case Study, management

- "Equating that production to assembly plants, this means there will be over ten surplus assembly plants in North America by 1990, as well as all the associated component and supplier plants providing material to those plants, and you can be sure some of them might be GM plants, some of them right here in Canada. In fact, there are five GM plants in North America without a firm product plan beyond 1990."

GM Truck, Employee Production Readiness Training Manual

- "Our biggest threat in Canada at this plant is not from Japan, not from Korea, not from any of those countries. Our biggest threat here is from the UAW in the U.S. Their people are saying they'd like to come up with some modern, progressive agreements . . . where we could have work groups, where we could have pay for performance, where people are paid based on the number of jobs they know in the group . . . I can see the U.S. people say 'we'll build that car for you, the one you're building in Windsor now. We'll build it at this or that plant that is under capacity', and they won't have the problems that we have here in Canada."

Chrysler Case Study, management

Fear and promise. The threat is clear. The message to workers is this: If you don't change your ways; if you don't cut down on the 'controllable absenteeism'; if you don't cut controllable costs; if you don't work smarter and maybe harder; if you don't get behind management on this, you won't have your job. The message to the union is also clear: without changes in contracts, without flexibility in rules, without more cooperation and better relations, there won't be a membership in this or that particular plant to worry about.

The Promise

Central to the language of the new managerial style is the primacy of the individual worker. In its practice management has targeted individual workers and the small production group.

- "We believe that the people who are actually producing in plant know what's going on with it."

  Engine Plant Case Study, management

- "Operator's input is very much valued. Let's face it, you work at a job eight hours a day, who knows more about the job than that person . . . so, number one, start talking with the operator."

  CanFab Case Study, management

- "Yes, all these departments exist to support the needs of the production assembler . . . The line operators have the best practical knowledge of the area . . . The primary function of all area management is to focus on the needs of the production operator."

  GM Truck Employee Production Readiness Training Manual

No doubt these testimonials are often glib and rote. But with them management is delivering a message to itself as well as to the worker. Management is telling itself to make production a central focus of the plant. It is reminding itself of the role of the production worker and it is telling workers that management is prepared to deal with them 'better', in production terms, than it has in the past.

Whether it is the EI program at Budd, the Employee Readiness Training at GM Truck, The Productivity Development System at Ford Glass, or any of its other numerous manifestations, the intent of the new managerial technology is clear. In terms of individual workers it can be summarized as follows:

- get them onside.
- get them thinking about business in management terms.
- get them solving production problems.
- give them the tools to solve problems — group dynamic skills, problem solving and effective communication.
- convince them they are equipped, and have the necessary skills and information, to solve the problems.

CASE STUDY

- As part of its five year plan Budd has organized a one day seminar for everybody in the plant, entitled "Human Relations in a Statistical Process Control Environment". If there was any doubt going in, there isn't coming out. By the end of the day participants are convinced that the old rules no longer apply. If Ford, GM and Chrysler are in trouble, then as a supplier Budd is doubly vulnerable: vulnerable to the Japanese and changing products and vulnerable to the shifting strategies of the auto majors . . .

  Talking to a group of workers who have seen their numbers drastically reduced about the 'new business reality' is something akin to preaching to the converted. But management considers it a necessary element in forging a new workplace relationship . . .

  Workers, however, are cast as the victims of the old production system. They are told that they have had major contributions to make all along, but management has failed to listen and has failed to provide them with the means to produce quality products. That will change!

  Before the end of the day F.W. Taylor has been abandoned and Scientific Management has been declared obsolete. In its place is the Human Relations School of Management to generate the motivation, and the 'Deming Concept' to provide the tools . . .

  The goal is clear. As the seminar kit explains: 'The major underemployed asset is the education, experience and creativity of the workforce'. The task for management is to transform what is, at present, an idle resource into a contributing factor of production.

  Budd Canada

- "One of the goals in managing the new GMT400 project is to provide each employee with the information that he or she needs to effectively run our business. Until now, most employees were never given the opportunity to understand what goes on behind the scenes and therefore did not understand what caused their supervisors to go wild when they used three pair of gloves in one day.

  We now have to find better and more efficient ways of doing business. This improvement can be accomplished through employee involvement and better management techniques.

  In this new approach each group member will be able to share, more effectively, in the running of the group. The information that you will need to be good managers will be readily available to you. With this information, you can make improvements which will guarantee a secure future for our business here in Oshawa."

  GM Truck Employee Production Readiness Training Manual

- encourage them to act as individuals and to relate to small groups.
- get them to identify their personal interest with those of the company.
- reward them by regarding them as adults, treating them with more respect, and by improving worker/supervisor relations.

The payoffs of such a strategy for the companies involved, if it is successful, are expressed in clear terms such as profitability, reduced waste, higher quality, a more motivated workforce and worker assistance in efforts to improve productivity. For workers the promises are more vague; the benefits more general. Workers will have 'more satisfying working relations' and a better 'work environment'. They will have a 'sense of accomplishment', an opportunity to 'participate more fully'. They will be treated with 'dignity and respect' and, to the degree the company is successful and maintains employment levels, they will have 'enhanced job security'.

THE NEW WORK MANAGEMENT INITIATIVES

Perhaps the most common expression of the new work management initiatives are Quality of Work Life (QWL) or Employee Involvement (EI) programs. In some workplaces they are official programs and in other locations they are informal. According to the CAW Technology Survey only one out of six plants has a formal program in place. About the same number again, however, indicated that the goals of EI/QWL were being achieved in other ways.

The formal program is exemplified by the EI program at Budd Canada. At Budd the program is endorsed by the union, the steering committee has shared union and management representation, there are two full-time facilitators — one a management employee and the other appointed by the union. In addition to being a "structured joint effort between management and the union", the program is based on certain ground rules. First, no jobs will be lost as a 'direct' result of the EI process. Second, the collective agreement and any contractual issues are off limits to the various EI groups. Third, issues related to individual performance and personalities are also out of bounds.

Official EI programs have made the rounds. All of the Big Three have or have had programs in at least some of their plants. A number of the independent parts plants, such as TRW, Kelsey-Hayes, Bendix, Budd and others also report their presence. In places where workers have withdrawn from official EI/QWL programs they often find them re-appearing in other forms: at an engine plant the focus is on training front line supervisors in new techniques; at Ford Glass the emphasis is on the 'work teams' that are associated with the two new tech lines; at GM Truck meeting rooms have been built on the shop floor in each area of the plant in case the natural working groups decide to meet.

As with so many of the issues associated with technological change, it is difficult to be conclusive about the new work management initiatives. In some locations they have been regarded as a success; in others disastrous. The variety of outcomes point to the diversity of management approaches and the range of worker reactions. If the programs are perceived to be neutral, rather than overt attempts by management to manipulate, workers generally support the initiatives. Furthermore, those workers who participate are more supportive than those who are not involved. Most workers regard the process — whether the training sessions, the teams or the groups — as a rewarding experience.

Ford Glass management was adamant that the feedback it received from individual workers on its PDS training course was highly favourable. Workers on the new tech lines at Ford Glass have accepted the role and place of problem solving. For them it is part of the new industrial culture, just as rotations, the freedom to move around and the shift from manual to more mental activities are part of this change. These workers argue that there are aspects of shop floor life which can be readily dealt with informally — between workers themselves and between workers and supervisors — in problem solving sessions.

Workers at GM Truck in Oshawa give the Employee Production Readiness course high marks. The Group Dynamics part of the course was rated 'good' to 'excellent' by 72% of participants, 60% expressed interest in future courses, 71% would recommend it and about two-thirds felt that the skills they acquired would help them in their jobs. The Problem Solving session scored even higher in all categories, with most of the scores around the 80% level. The Quality Management section was also well-received, with about 76% of the workers rating the subject matter as good to excellent.

At Budd, the workers credit the EI program with having led to improved working conditions and better day-

CASE STUDY

- The 'teams' on the new tech lines get together occasionally in problem solving sessions. These sessions seem to be a variation on the 'safety groups', which were a variation on EI. Now they are offering courses in Productivity Development System (PDS). These four hour courses were at first voluntary but later became compulsory. And they, in turn, were an introduction to a three-day company paid course. PDS, with its emphasis on problem-solving, group dynamics, team building and communication skills, looks remarkably similar to Ford's EI courses.

Ford Glass

- In March, 1985 the local put the issue to a plant wide referendum and the EI program was defeated. Since that time, some workers contend, management has tried to bring EI in through the back door, through such things as 'communication meetings' and training front line supervisors in EI techniques and processes. As one worker put it: 'The monthly meetings, coffee clubs, breakfast meetings, that's another way of bringing in EI. We go upstairs for a safety meeting and what's the first thing they do? They give you a state of the company address. That's the first step in so called Quality Circles. They're smart.'

Engine Plant

to-day relations on the shop floor. The following comments are typical:

- "It gives me an opportunity to have a say."
- "Things are finally changing around here."
- "When your supervisor is helping you out . . . it makes a big difference."
- "We don't have to leave our heads where we badge in."
- "The difference is night and day."
- "I don't see how we could lose. Would they come and take away the picnic tables, the water coolers, etc."

Although individual workers are generally supportive of the new management style and initiatives, at times they are also quick to criticize management, condemn the program and withdraw their support. This reaction is due partly to their heightened expectations of change, partly to blatant manipulation by management. In some workplaces the spirit of cooperation is fragile, even illusory; it is easily shattered when management reverts to its old ways, when the new worker/supervisor relationship is revealed as cosmetic, or when there is a dispute between management and the union. In such situations management's efforts are interpreted as fraudulent; as an attempt to manipulate loyalties and erode support for the union. At issue is not the particular form or expression of the new managerial style, but the intent behind it.

The new managerial technology poses another dilemma for workers and their unions. New technology is seen as job destroying, but at the same time it is seen as job preserving. In a parallel fashion, management's new initiatives are seen as generating support from workers and they are seen as a means of improving the conditions of work. At the same time they are seen as a way of weakening workers' power to resist future changes which could undermine the quality of working life. Both trends are perceptible.

Management is in a struggle for survival. It needs a dedicated and skilled workforce to bring about the required transformation in production. In order to build the commitment from its workers, management has to demonstrate its willingness to change. That means changing relations and changing working conditions. At the same time, it means that management has to equip workers with the new skills and perspectives that will allow them to respond.

Programs such as EI and the other forms of problem solving and human relations training are the instruments of this change. By treating workers better management hopes it will increase workers' identification with the company. This raises expectations while it shapes attitudes. Management can then attempt to translate the new attitudes and identification with itself into less support for the union. The outcome at this point depends on whether the union is seen as resisting change and jeopardizing chances for survival, or whether management fails to live up to the heightened expectation, fails to deliver on improved conditions and fails to convince workers that its initiatives are honest.

Whatever the outcome, it is clear that technological change has shifted the cultural initiative to management.

CASE STUDY

- There are indications that the new technology lines are becoming separate from the rest of the plant. It seems that the team relationship — combined with the special training courses and ongoing efforts to engage the operators in problem solving — has created definable 'islands' in the plant. As one worker expressed it: "The new lines are separate entities . . . They don't mix like they used to."

The new technology attendants admit to feelings of a special status: "You can feel the difference . . . You feel you're part of the group. Management puts more emphasis on you . . . You feel as if you're somebody."

Some see in management's efforts a deliberate attempt to foster separateness and special status. Some see the new tech operators as being given preferential treatment: "What they're doing with these teams is divide and conquer."

The new tech lines have fractured the plant in other ways . . . in particular around the issues of seniority in production and specialization in the trades.

Ford Glass

- "The foremen are getting trained. Management plays it that way. They say 'no' to the rep but they say 'yes' to the guy with the problem. That's how they do it. Its all a psychological strategy that they're using on us out there every day. Its all in their coursebooks. They're training everyone of them in that . . ."

"All the time they're screwing us they put it on the floor that they are such nice guys. There is a battle for whose side the membership is on . . ."

Engine Plant, union rep

Management has taken the lead in introducing workplace changes and through these initiatives has established new lines of communication with individual workers. Furthermore, it is clear that consequences of these changes arise not only from the outcomes of these changes, but from the process of change itself.

If the new 'work management' initiatives were all that were going on in the workplace, they would be enough to contend with. That isn't the case. The initiatives in employee relations have their counterpart in management's agenda for labour relations; one is the thin edge of the wedge for the other. It is one thing to have a committed and productive workforce, but quite another to be able to deploy it in an unrestrictive manner.

THE NEW LABOUR RELATIONS

Three out of four respondents to the CAW Technology Survey indicated that in the last five years there has been a noticeable change in management's style, attitude and behaviour. Over half (56%) reported that Labour/Management relations are characterized by a more open and cooperative style than in the past. When it comes to the issues of Labour/Management relations there are two

issues to be explored: the nature of the change and its direction.

Technological change is related to the package of new 'work management' initiatives, and both are co-terminous with changes in the contractual framework of the work place. Robots and other equipment, problem-solving, demarcations and work rules, are all part of the 'new way of doing business'.

The reforms promoted by management have one thing in common: if implemented they will give management more freedom and flexibility in the workplace. Capital mobility and management flexibility are two sides of the same coin. In worksites that are becoming more automated management wants more flexibility in deploying workers, rewarding workers and, as a corollary, fewer restrictions in assigning workers tasks and duties. What is less clear is this: if management is accommodated, what are they prepared to give in return? These, and related, matters are causing turbulence in Labour-Management relations and threaten to upset established arrangements.

The companies have made it clear that they want changes. Management at an engine plant took union reps on a tour of Japanese production to see how things were arranged there. At GM union reps and workers from the GM Truck plant have been taken to a number of different plants. Chrysler took union reps from the Mini-Van plant on a tour of a Mitsubishi plant in Australia to see first-hand what the company meant in its movie 'Playing To Win'. Whatever the delivery, the message is the same. At an engine plant management talked about the attractiveness of the Japanese model where:

> "The scope of work is broader, demarcation nebulous. There's maybe only two trades; you don't see the lines of demarcation. The guys on the line will expand the work they are capable of doing."

At GM Truck, management reported on the success of the Quality Circle type of programs, the changes in classifications and the team concept that they had seen in Louisville. At Chrysler, management is impressed with the type of labour-management relations where:

> "We'd get rid of supervisors and have leaders, where we could have work groups, where we could have pay for performance, where people are paid based on the number of jobs they know in the group."

North American management is clearly influenced by the economic success of other countries. They are captivated by the labour relations differences they see as contributing to that success. They are especially intrigued when those features can be transplanted here and still flourish. At present the pride of the crop are the NUMMI-style agreements shaped by the GM-Toyota joint venture in Fremont California.

The "NUMMIsation" of U.S. labour relations is quite apparent in the agreements that have been negotiated south of the border. In a report on organizational competitiveness, for instance, a GM manager assured the Board of Directors that:

> "The transfer of technology and management philosophy between NUMMI and General Motors *is* taking place. The new agreement at the Fairfax Assembly plant is almost identical to NUMMI. Other plants like Linden, Wilmington, Van Guys, and Framingham are currently negotiating based on their NUMMI studies. We are nurturing this process very carefully."

In Canadian auto plants there is a lot of talk about new relations. In many plants management has either approached the union directly, to discuss the philosophy and even negotiate changes in those directions, or else they have tried to implement changes that serve to increase their flexibility on a piece-meal basis. Management has a sense of where it wants to go, if not now, at least for the future. At Chrysler Mini-Van a local manager reported:

> "I think that's the sort of thing that we're looking at in the future. That's the sort of thing we're starting to talk to the union about."

At GM in Oshawa company officials stress the differences between work teams NUMMI-style and their own Natural Work Group approach, but they also suggest that the situation could evolve. At an engine plant, management

BASIC ELEMENTS OF NUMMI-TYPE AGREEMENTS

- **The team concept.**
  The organization of the hourly workforce into small teams leds by an hourly team leader. Team members are cross-trained and multi-skilled in terms of the different tasks of the team, with some of their pay rate related to 'pay for knowledge'. The teams are involved in 'problem-solving' and housekeeping and the leaders perform some functions normally associated with non-hourly staff.
- **Broad operator responsibilities.**
  Few non-skilled hourly classifications. No 'job ownership'. Workers perform a wide range of functions, including housekeeping, minor maintenance, minor repair, inspection and record keeping.
- **Consolidated trade classifications.**
  Very limited number of trade classifications. Consolidation 'within' and 'across' basic trade categories. At times trade classifications unique to the facility, and at times new specialized trades.
- **Range of wages and benefits.**
  Wages that are locally set, differentials between existing and new-hire rates, stretched progression schedules and part of the wage package tied to performance, productivity or profitability.
- **Wide range of other changes.**
  Outsourcing of many activities, from landscaping to payroll. Varied length of agreements. Changed rules governing transfers, absenteeism, union representation, etc.

has made it clear that it wants fewer trade classifications and it wants production jobs which have additional duties.

Job Duties and Lines of Demarcation

Changes to job duties and the lines of demarcation, in both skilled and production classifications, seem to be the most common assaults management is making on existing arrangements. Evidence from the CAW Technology Survey supports this conclusion. Forty-three percent of plants reported that jobs had been given added duties and responsibilities as a result of new technology. In more than one in four plants the lines between jobs, between trades and between classification have been 'blurred'. In one out of five plants management has attempted to eliminate certain job classifications as a result of technological change. Furthermore, in considerably more than half of the cases (62%), respondents agree that the lines of demarcation between various trades are breaking down.

The most common occurences in the sample include:

- inspection classifications which are either eliminated or given added responsibilities;
- machine operators performing some set-up and minor repair functions; and
- direct production workers being given inspection (SPC) and minor repair duties.

In the skilled trades, in addition to the encroachment by production categories on some marginal maintenance tasks, the most common situations are;

- efforts to consolidate or collapse the mechanical trades;
- crossing the basic trade boundaries in the creation of a new repair/maintenance trade; and
- adding 'electronic' responsibilities to electrician jobs or creating a new 'electronic' job classification.

Job duties and classifications are where most of the skirmishes occur, but the friction extends to issues such as relief schedules, off-line jobs, transfer and seniority rights, absenteeism and, as always, cost.

Some in management see that the broader changes they want will have to wait; in other cases the broader changes are already happening.

- "It's not really the right time. The right time is when you're ready to shut the plant down . . . and the union says: 'what do you need to keep it going'' and you say: "Here's what I need."

  Chrysler Case Study

- "Your improvements in quality are remarkable. The plant's enhanced productivity and working environment are tremendous. And the new local labour agreement is the cornerstone in building the future in Boisbriand. By your on-going commitment to continuous improvement, you have earned the right to that future.

  We've had to work hard within General Motors Corporation to get a product allocation, and without the new local agreement and improved quality levels, we could not have done it."

  GM Canada President G. Peapples

CASE STUDY

- "They want three trades — mechanical, electrician and a high pressure welder — and that's all. They already started it when they made machine repair and toolmaker the same trade. I would say that down the road they are going to get they want."

  "Two years ago Engineering wanted to put as a prerequisite that all electrical apprentices had to have two years at college in electronic technology before they could start an apprenticeship. They didn't get it but you can see a trend."

  Engine Plant, union rep

- "(Management wants a) welder repair classification. That classification is taking the job away from possibly three different trades: the millwright, electrician and machine repairman. These three classifications are involved in robotics. What they want to do is eliminate these three classifications in high production areas like Robogate and have what they call a welder repair who is trained specifically on the handling of these robots."

  "There are a lot of minor things involved in these classifications that really anybody can do, but it has historically been a part of that trade and part of that classification and it belongs there. If you start deviating away from that, its a foot in the door to dilute your classifications . . . Its a constant thing. They're picking away at it."

  Chrysler, union rep

THE RESPONSE

The new management agenda is clear; less so, workers' response. Some workers and union reps see the new way of doing business as a tougher, meaner version of the old way of doing business: "it means concessions, changes in work practices, classification changes, elimination of union representation," argues one local union leader. Others see that in the changes there are opportunities as well as limitations; that changes in job duties might make some jobs more interesting; that changes in classifications need not be all that threatenening; that more flexibility for management need not mean fewer workers rights or less worker solidarity; that changes might increase productivity, reduce costs and strengthen job security. Then again, there is always the possibility that the changes won't achieve management objectives regardless of their impact on the workforce; that, caught up in the fad of change, management has chosen a direction that is counter-productive and will, in the long run, threaten what both labour and management require.

Management has set its agenda and it has taken the initiative in defining changes in the work place, in the relations at work, and in the more formal labour-management arena. As a result, in the words of one local union rep: "we're going to be faced with some serious decisions on this down the road because they're pushing the change; we're going to feel the wave."

THE NEW MANAGEMENT AGENDA SUMMARY

- The introduction of new technology means production with fewer workers, but it also means that there is an increased reliance on those workers.
- New technology poses a dilemma for management: can it secure greater worker involvement in production without relinquishing its control over production?
- Technological change implies the technical and social transformation of production. Along with new equipment and processes come changes in management values and attitudes.
- A revised "Managerial Technology" — a new management style and philosophy — is now emerging in the industry.
- The basic elements of the new management initiative include a shift from Labour Relations to the less formal employee relations, a new focus on individuals and small groups and increased employee involvement.
- The new initiative is intended to enlist the cooperation of workers and foster new attitudes in the workplace; management wants a committed and skilled workforce at its command.
- To succeed, management must overcome worker resistance to technological change and then transform that compliance into commitment.
- Worker involvement is becoming a prerequisite of the new technology. The new management initiative is designed to encourage and manage that involvement.
- The new management philosophy is a blend of fear and promise; the threat of the Japanese and the lessons of human relations.
- It has five core elements: the Japanese competitive edge; close the gap or forfeit our jobs; the goal is to increase quality and productivity; workers and management are in this together; survival depends on new technology, new relations and a new way of doing business.
- A sixth element has recently been added: U.S. workers are prepared to face the facts, they are the new competition.
- If successful the payoffs of this new approach will be real for management: higher profits and quality; reduced waste; better motivated and more committed workers.
- Promises for workers are more vague: more satisfying work relations; a sense of accomplishment; increased participation, dignity and respect, and perhaps job security.
- The most common expression of this new management initiative, and an increasingly common occurance in auto, are QWL and EI-type programs.
- The CAW Technology Survey indicates about one in three plants in the industry currently has a formal or informal program of this type.
- Even though workers are often supportive of the new management style and initiatives, they are quick to criticize management if they sense manipulation.
- The spirit of cooperation is fragile; it is easily shattered.
- It is not the form or expression of the new management style that workers challenge, it is the intent behind it.
- The union is faced with a real dilemma: the new management style generates support from workers and it can improve working conditions. It can also weaken workers' power to resist future concessions.
- The new programs are management's instruments of workplace change, but while they shape worker attitudes they also increase worker expectations.
- It is not just the outcomes of these new initiatives that determine consequences, it is also the process itself.
- Management has taken the initiative in introducing processes for workplace change. Through these processes they have established new lines of communication with individual workers.
- A labour relations strategy is also part of management's new initiative: robots, problem solving, demarcations and work rules are all part of the new way of doing business.
- Each aspect of this new management strategy has one thing in common; if implemented, it gives management more freedom and flexibility in the workplace.
- The most common labour relations expressions of the new way of doing business are pressures from management to change job duties and eliminate classifications and demarcation lines.
- Other attacks on traditional work rules have come in the areas of relief schedules, off-line jobs, transfer and seniority rights and absenteeism. The focus in each case is cost.
- Management's agenda is clear. They have taken the initiative in defining workplace changes.
- To date the union's response is less clear; the union has yet to define its agenda for change.

LABOUR AND THE PROCESS OF TECHNOLOGICAL CHANGE

Technological change serves a variety of ends for management. At various times and locations technology is introduced to:

- improve productivity, increase efficiencies and to reduce costs.
- standardize production methods and strengthen control over pace and quality of production.
- reduce direct and indirect labour levels and requirements and, at times, enable the use of workers with fewer skills.
- facilitate the reorganization of work to increase flexibility and mobility of labour, spread tasks among fewer workers and improve the output of work time.

Although each of these goals represent an area of potential conflict with workers, new technology is accepted and even supported by workers. In the master agreement between GM and the Union, for example, the Statement on Technological Progress reads in part:

> "In successive Master Agreements the parties have recognized that continuing improvements in the standard of living of the employees covered thereby depends upon technological progress, better tools, methods, processes and equipment as well as a cooperative attitude on the part of all parties in such progress."

In such a context the role of the union has evolved as one of protecting workers against the detrimental effects of technological change while, to a lesser degree, striving to promote its beneficial impacts. Ultimately the success of union efforts on both these fronts depends on a variety of political, economic and social factors.

Management's approach to technological change, and the union's role in the process, is conditioned by a broad range of historical and institutional forces; from broad macro-economic trends to the perceptions of individual local union leaders. As a result it is not surprising to find that while the contours of the technological change process are the same across the industry, the specifics range dramatically from cases of unprecedented cooperation to cases of concealment and arbitrary imposition. But in every case the process of technological change affects the character of labour-management relations. In turn the nature of labour-management relations will affect the implementation of new technology and its consequences for workers and the work environment.

THE MODELS OF CHANGE

There are basically three models which characterize the different approaches to technological change. The distinguishing feature of each model — a different point along the continuum — is the degree to which workers and their unions are involved in the process.

1) Autocratic

One pole is occupied by the classic autocratic or technocratic approach. In this model the introduction of new technology is perceived as an undisputed managerial prerogative. Implicit in this approach is the traditional organization of the workplace as a kind of military hierarchy, with an operational philosophy adhering to the principles of Scientific Management. Just as important in this approach is the treatment of technology as strictly a technical issue: a robot, a computer, a numerically controlled lathe are, in this view, simply machines, pieces of equipment that require no more consideration than previous generations of tools, equipment and processes. New Technology is an Industrial Engineering function and workers' tasks and jobs are treated as the residual factor after the machines have been put in place. Workers, to the degree they are taken into account at all, are treated as one more variable in the engineering equation, or else as a potential force of disruption that has to be controlled.

2) Human Relations

In the middle lies an enlightened capitalist approach which could be called the Human Relations approach. This approach stems from management's own critique of the autocratic approach, as well as from the influence of outside consultants. Managers have realized that new technology cannot be considered as just another machine. As such, the assumptions and style of the autocratic approach, far from ensuring the effective implementation of new technology, has become an obstacle to technological change. The Human Relations approach recognizes the role of workers as a source of information and expertise in the workplace. The gospel of this approach is not only to reduce resistance, but to develop worker commitment to technological and organizational change.

Workers, in this view, have an important role to play in the process of technological change and in working with new technology. Their viewpoints are solicited and considered, and somewhat more attention is paid to task grouping, job content and design. The Human Relations approach seeks participation, but in the end it seeks to control participation. It is based on the principle of cooperation, but whenever attempts at cooperation fail, management's position is immediately re-asserted as the dominant one.

3) Negotiation

Occupying the remaining pole is the negotiation model. This approach recognizes conflicting interest in the workplace and it formalizes the rights of workers, and the explicit role of their union, in the decision making process concerning new technology.

Like most real life situations, the process of technological change in the auto industry resists being neatly categorized by any particular model. The details of specific cases of technological change vary from one to another and may be in conflict with broader trends. Even so, there is a general pattern that has emerged.

- The historical trend is from the autocratic to the Human Relations approach.
- Specific situations are usually hybrid ones — a clinging to the old approach combined with some new initiatives in participation.
- A technological change model based on negotiation has yet to be developed.

THE COLLECTIVE AGREEMENTS

The process of technological change has both a formal and an informal dimension. The former is defined by collective bargaining; it is governed by the regulatory framework of industrial relations; it is expressed in the legal language of the Agreements. The latter is an informal process — the day to day cooperation (or the lack of it) — which is influenced by the personal relations between managers and union reps. In any particular plant outcomes of technological change are shaped at both levels.

At the formal level the process of technological change is structured by the provisions of the collective agreements. In particular, the following factors stand out: the extent and coverage of the contract language; whether events

CASE STUDY

- The GM Truck plant could be considered an innovation in worker involvement in technological change. Early on in the process local management, determined to avoid the problems of the past, decided to involve workers and union reps in the "mammoth project".

In the process of gutting and rebuilding the truck plant, management wanted to change shop floor attitudes and transform the "bitter union rep" and "hardline management" styles that had led to continuing "skirmishes". The success of the project depended on reducing conflict. As one manager expressed it: "We can't use the product or the floor as a battleground any more."

The strategy management adopted was one of discussion and participation: keep the union informed, get hourly employees directly involved, and make some compromises in return for some compromises. A management memo dated May 2, 1984 on the subject of the 1987 Layouts reports:

> 'It is necessary that we begin to involve Union Representatives in the 1987 model change. The layouts are not finalized and Union input can serve to inform them of the scope of the project to date but more importantly use their experience and ideas to help ensure that nothing is overlooked.'

The memo, after taking care of some meeting times and a preliminary schedule of topics, goes on to state:

> 'We look forward to the opportunity of sharing ideas and information ... We must deeply involve and train our people since the systems are drastically different. Team building, stop and go processing, robotics and a vastly different build is prevalent throughout. The full use of our human resources is the only way to meet the quality goals of sustained excellence.'

Following up on the memo management invited district committeemen, zone committeemen and elected alternates from both shifts to attend a series of biweekly meetings that were scheduled for two hours on Friday mornings. The last scheduled meeting on July 18, 1986, was the 55th such meeting, and at that time it was decided to continue them in order to "discuss items of mutual interest".

Judging by the agendas, the meetings were structured as briefing sessions, an opportunity to disseminate information and discuss implications on a number of recurring topics:

- physical layout, technical and engineering progress reports.
- automation and labour requirements, forecasts and reviews.
- reviews and briefings on particular technologies (AGVs).
- facilities (parking lots, cafeterias, lunch rooms).
- ergonomic and health and safety considerations.
- new work concepts (teamwork, EI, classifications).
- training programs and skill requirements.

In addition to the bi-weekly meetings with union reps, management set up a series of tours to other facilities for the union and for hourly employees, hired training co-ordinators from the hourly ranks, established a special Communication Group made up of hourly staff, seconded one hourly worker from each area to provide input to Industrial Engineering in writing up the new job descriptions, and organized a series of update meetings for everyone in the plant.

Without diminishing the importance of the innovations, the process was still clearly a management initiative. The union was involved and was kept informed. It was given access and some informal rights and there was participation, but in the end it conformed to management's agenda.

GM Truck

actually conform to the clauses or letters; the relative strengths and weaknesses of the language. Responses by local unions to the CAW Technology Survey provides some relevant information on each of these points.

Coverage

Less than half (41%) of the plants which responded to the survey have a technological change clause or letter in their agreements. Whether or not there is a clause is related to the size of the plant. Only one in five of the small plants have language, more than one in three (40%) of the medium sized plants have language; most of the large plants (87%) have language on new technology. It is also related to sector. Less than one third (29%) of the independent parts companies report contract language.

Where there is language, there is a considerable range in its terms. One small independent parts company, for example, has a Letter of Understanding appended to the agreement which reads in part:

> "The company will also notify the union as early as possible of the intended introduction of new manufacturing technology and make recommendations as to outside courses of study that could be taken so that employees will have the ability to acquire skills to assist them in preparing for on-the-job training when new manufacturing technology is introduced."

Alternatively, some plants have contract articles which specify matters such as notice period, the definition of 'technology' and the recourse against infractions.

CASE STUDY

- The union is told about technological change — at times there are discussions — but the union never participates in the process of technological change. At the Niagara Glass plant consultation usually takes the form of workers hearing a rumour and the union tracking it down. While the contract is explicit on the matter there is little evidence to suggest that written notice is regularly provided by management. In the case of the NC line, for instance, neither the local union nor the IR department could find such a record in their files.

  As a result of the union's efforts, and although 'each situation varies', the parties usually get together to discuss new technology. But the local recognizes that it has very limited rights in the area of technological change.

  The union, no doubt, deals with technological change. At the Niagara plant it is clear that the union has a lot to do as a result of technological change. It tries to insure that seniority is honoured, that job classifications are not arbitrarily changed, that work rules are respected. It has to argue, cajole and in those limited areas where it has the right to grieve, to do so, in its efforts to protect individual workers and the bargaining unit.

  In the end, the fact remains that management is in control and that decisions about technological change strictly conform to a hierarchial model.

Ford Glass

Compliance and Conformity

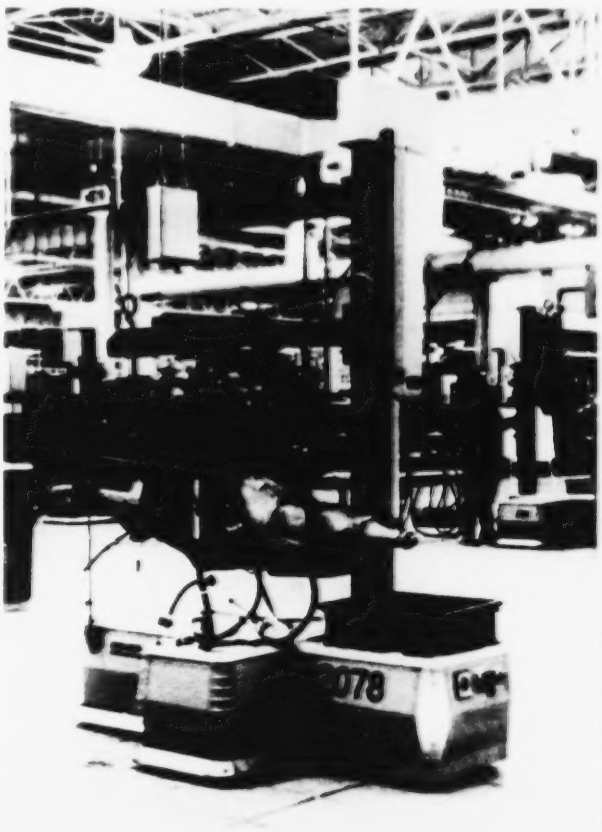
Only half of those plants with contract language report that the introduction of new technology 'always' or 'frequently' conforms to the terms of the collective agreement. One in five actually express the view that technological change 'seldom' conforms to the agreement.

On a related but separate issue, over half of the plants report that they are regularly consulted on the introduction of new technology. Although 'consultation' occurs even in the absence of language (the informal level), language does increase the probability of consultation. Two thirds of the plants with clauses or letters on technological change are regularly consulted, while less than half of those without language are regularly consulted.

More small and medium sized plants are 'regularly consulted' than actually have language. This is not the case in the large plant category (500 or more workers). Here there is a higher number of plants with language than there are plants which are regularly consulted. While this suggests difficulties with compliance in larger plants, it also points to different perceptions of what, in fact, constitutes consultation.

Advance Notice

Advance notice of impending technological change varies widely from plant to plant in terms of the notice period, whether the time frame is considered adequate, and the type of information the union receives. Very few units actually have a notice period prescribed in the collective



Engine carrier AGV.

agreement. Some agreements have 'notice periods' that are left open and include references such as 'sufficient notice', or 'as much as possible in advance'. Some simply imply that notice will be given, and many are silent on the matter altogether. Even so, 42% of the survey respondents reported that, at least in some cases, they had received notice from the company even before new equipment was purchased.

In addition to the above notice provisions, a number of contracts, but in particular Ford's and GM's, require the parties to establish Technology Committees at either, or both, the national and the local level. At times these committees are restricted to discussing training programs. In the case of Ford and GM these committees are supposed to meet on a regular basis to "discuss the development of new technology . . . and its possible impact on the scope of the bargaining unit . . . and other matters . . . referred by local unions." In the case of GM the Master Committee is paralleled at each plant by a 'Local New Technology Committee'.

Information

The most common information companies provide are the following:

- The reasons for considering the introduction of new technology.
- A proposed timetable for the introduction.
- An assessment of the impact on the number of people and the skills required.

Although these are the most frequent categories of information, considerably less than half of the survey respondents (40%) actually manage to obtain such information. And while the likelihood of gaining access to such data increases significantly if there is language in the agreement, still only half of those plants with language report obtaining such information. Rarely do clauses on technological change specify the information to be provided to the union.

WHO GETS WHAT

(Proportion of plants *with* tech change language who report getting the following information.)

The reasons for considering the introduction.	53%
Technical explanation of nature and scope of proposed change.	34%
A financial assessment of the costs involved.	24%
A detailed report of the tasks to be performed by the new equipment.	50%
A proposed timetable for the introduction of the change.	58%
Impact on workers in terms of the number of people and the skills required.	47%
The anticipated effect on workflow, work methods.	37%
The anticipated effect on hours.	18%
Any changes to supervision.	21%

The various GM locals that responded to the CAW Technology Survey are all covered by the same contract provisions on new technology. But judging by the difference in their perceptions and reactions, it almost seems as if they have different collective agreements.

- on whether or not the locals are regularly consulted about technological change; some say yes while others say no;
- the notice period ranges from 'after installation' to 4 months in advance;
- whether or not the notice is sufficient, half say yes and the other half say no;
- whether the process conforms to the agreement; the range is from 'seldom' to 'always'; and
- the answers are mixed on whether the local technology committee meets regularly.

Participation

Only one out of four units reported that they have had the opportunity to review equipment before it was installed. About the same number indicated that they have had the chance to modify equipment before it was installed. Over half have been involved in modifying some equipment after it was purchased and installed. In those instances where equipment has been modified either before or after installation, the modification involved health and injury safeguards, such as the reduction of noise levels, or the building of guard rails.

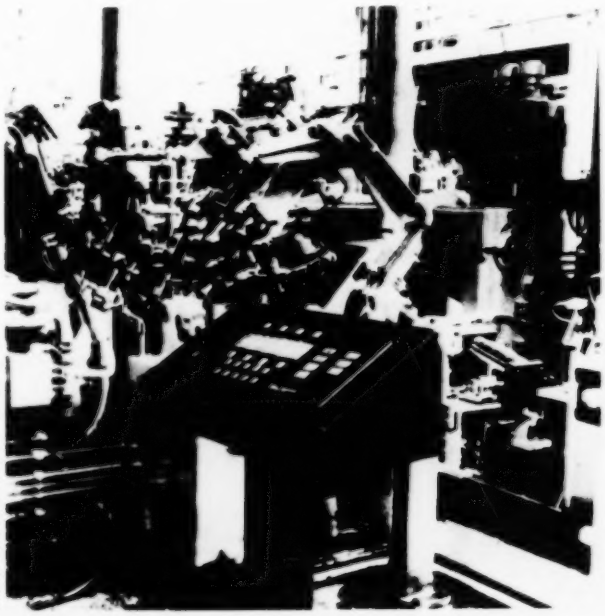
CONTRACT ISSUES

Judging by the contracts themselves, what respondents report about the consultative process and the type of information that companies provide to the union, the contracts can be summarized as emphasizing the following issues:

- the impact of technology on bargaining unit work and efforts to prevent the shift of work from represented to excluded workers.
- attempts to get the companies to provide retraining to workers displaced by the new technology.
- efforts to provide training opportunities for those skilled trades who will be installing and maintaining the new technology.

In many contracts it is the latter point — the terms and provisions pertaining to the training of the skilled trades — which is stressed.

Even these quite basic efforts at negotiation are resisted by management. The collective agreements reflect these limits in language. Most contract clauses are drafted in terms of what management considers to be 'reasonable and practicable', union comments being 'carefully evaluated', training programs offered 'whenever possible', and to workers who have the 'adaptability'.



On the whole, the current provisions of collective agreements on technological change are out of step with the impact of those changes. What might have been adequate — even pioneering — when the language was first adopted is now insufficient. It suffers from a number of shortcomings. Notice of impending changes are, as a rule, not advanced enough. There is a corollary to this: it doesn't matter how much in advance the notice is if there is no subsequent role for the union. Information is often inadequate and varies from situation to situation and location to location. Information is powerful only in so far as it is the right information and only in so far as it brings to light alternatives and the choices among them. Furthermore, consultation is often superficial, as it will be so long as participation is a privilege conferred, and not a right to be exercised. There is, at present, very limited negotiation on technological change.

The issue of new technology and its impact was first addressed by the skilled trade workers within the union. Current provisions of the collective agreements reflect these initial efforts. Increasingly, as the pace of technological change has accelerated and as its impacts have broadened, the issue of new technology has developed into one with union-wide ramifications.

TRAINING AND TECHNOLOGY

Training has become a prerequisite of the new technology; as central to its success as the equipment itself. At one level it is a relatively straightforward requirement, involving the teaching of technical skills to those who operate, maintain and repair the new equipment. But at another level the issue is more complex. In the context of technological change, training has become charged with a double responsibility; the transmission of technical and analytic skills and the fostering of a new set of workforce attitudes — identification with the corporation and stressing cooperative relations with management.

Technological change has forced management to pay more attention to training than it has in the past. The new emphasis on training is apparent: when Chrysler converted Windsor assembly plant #3 for the production of the mini-van it provided a total of 900,000 person-hours of training to its workforce; the training program for the GM Truck plant conversion included a basic six days (48 hours) of classroom and hands-on training for all 2,600 hourly workers; adjunct training centres and full time trainers have recently been added at Ford Glass, Chrysler, GM Ste Therese and Essex Engine; hundreds of workers are being sent away to equipment vendors or special centres for training courses, and scores of workers are receiving new on-the-job training. There is more time, money and facilities devoted to training than ever before.

Technology requires new and different skills. The content and focus of training is shifting to meet these requirements. The general trend is toward: (a) higher basic academic skills; (b) special technical skills (i.e. electronics) (c) more emphasis on analytic skills, such as problem solving, data interpretation and diagnosis. To these three must be added a fourth; what some in the industry refer to as 'cultural training'. Cultural training — strengthening the commitment of workers to production, developing a commonality of interest between workers and management, and increasing the flexibility and adaptability of individual workers, and the workforce in general — is becoming a dominant theme of corporate training initiatives.

Worker Reactions and Attitudes

For workers the issue of training is directly tied to employment security, on the one hand, and access to better

CASE STUDY

A February 1985 GM Truck plant memo outlining the six day Employee Production Readiness training program provided to all hourly employees during the recent plant conversion, indicated the relative weighting of the components as follows:

- cultural change training 70%
- product training 11%
- process training 8%
- specific skills training 8%
- specific management skills 3%

The training course included major sections that dealt with:

- group dynamics, participation styles and communication skills
- business objectives and measurements
- problem diagnoses and solutions

The program was designed to insure that "every truck plant employee will have learned the skills used in group dynamics and systematic problem solving as well as hands on, job operations training." The goal of the training was to develop a "well educated, trained and involved" workforce and to equip them with the tools necessary for "our journey to world class".

GM Truck

jobs, on the other. Respondents to the CAW Technology Survey ranked training as one of the top three issues for union action on new technology. Furthermore, eighty-five percent indicated a need for programs of continuing education to respond to constantly changing technology and jobs.

- "What we have to do is get more of our people trained — work on that type of thing. I'd like to keep up with the technology, really, just as long as they keep educating me."

  Budd Canada Case Study, worker

- "It's necessary for management to keep retraining their people as things change — to keep them up to date — because everything is changing. It's changing so fast that we have to continually train our own people to keep up with it."

  Chrysler Case Study, union rep

- Workers at both UAP locations in Quebec City report that training was not offered on the new technology. In one situation workers on the order desks could not use the new equipment, and in the parts distribution centre workers were prohibited from bidding into new jobs because they had not been trained on the new equipment.

  Quebec Roundtable

While training is potentially an area of common ground between workers and management, there are clear signs of tension and conflict over training choices and directions. At issue is:

- the extent of training,
- the content and appropriateness of the trianing courses,
- the uneven distribution of training,
- the process by which management selects those who will receive training, and
- more generally, the matter of management control of training.

While technology has led to a new corporate emphasis on training, that in itself is not a guarantee of anything. Many workers argue that there isn't enough training and they question management's commitment.

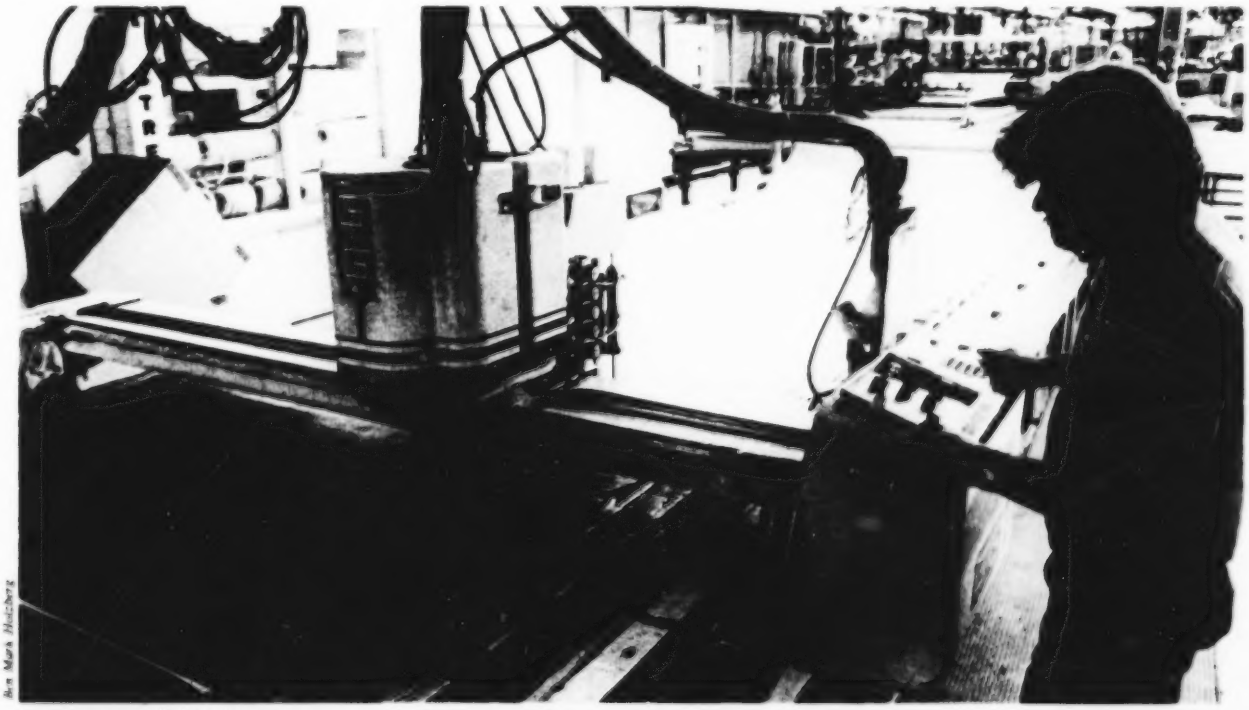
- At one level workers believe that all the talk about training is just a lot of hype. In the words of one, 'they're not really training people', and another, 'they don't educate you enough. They should be forced to retrain you'.

  Engine Plant Case Study

- "They seem to be reluctant to train extra people on these machines. They just want one, and if they add a second machine they train the second guy."

  Tool and Die Roundtable, worker

When workers aren't trained, the door is open for the company to use outside contractors, to have management employees do what would otherwise be bargaining unit work, and to have 'new hires' in jobs that could be filled from within the ranks.



Jim Mark Holzberg

Computer controlled Gerber cutter.

- The question of access to new technology training for the skilled trades has an important job security dimension at Chrysler, as elsewhere. Lack of training is often an argument used by the company to justify hiring outside contractors:

  "In the trades we've got to have our guys trained. If you don't, you've got a lot of problems. They then use the excuse of needing outside contractors to install and repair the equipment because our guys aren't knowledgeable."

  Chrysler Case Study

- "What they're doing is going to St. Clair College and getting kids from there who have computer training but absolutely no tool knowledge at all. When they bring in the new machine it's the kid they put on it because he had some computer experience. Our company just absolutely refuses to train anybody."

  Tool and Die Roundtable, worker

CASE STUDY

- The system for allocating technical training among the trades (here) is based on what the union calls the 'red apple' system:

  "Who gets trained depends on who the foreman likes. We call it the red apple system around here ... We should have training by seniority. Basically one of the things the union really fought for was seniority rights. You have got to have your seniority count for something. Forget the ability. I as a person know how much I am able. I can turn down the training but it should be offered. I should be the one that says yes or no."

  Engine Plant

- The training of the skilled trades has been caught up in issues of access and charges of agism and favouritism ... although everyone received the basic training, management has discouraged older workers from getting more involved and it has provided advanced training to only selected trades people ... The system used to be that, whenever there was a problem with equipment, the trades department was called and whoever was available did the job. Now only a select group of mechanics are sent out to the 'coater' and only a few electricians work the NC line. The complaint of some skilled trades workers is that management has "taken a few electricians under wing" and has given them special attention and access to the new technology.

  Ford Glass

When training is provided, some workers complain that it is haphazard, poorly planned and inadequate in terms of the task at hand:

- "I remember this training course we were sent to over in Troy, Michigan at a company that was supplying equipment. After driving there and back we had six hours a day. It was wasted. The first two days all you get is all this hype for their product. They were just giving you a sales pitch. We didn't get enough training to fix anything."

  Engine Plant Case Study, worker

The distribution of new technology training is uneven between companies. But new technology training is also unevenly distributed within the same company as well, between salaried and hourly workers, and within the ranks of hourly workers.

Office members have made a variety of suggestions to management about ways to improve computer-related equipment and procedures. Here is a list of the areas of those suggestions.

AREA	PERCENT OF THOSE WHO SAID MANAGEMENT ACTED ON SUGGESTIONS
Tiltable screens	60%
Adjustable chairs	88%
Non-glare screens	80%
Lighting	71%
Noise	57%
Content of training	57%
Length of training	50%
Software needs or changes	88%
Purchase of better hardware	43%
More efficient organization or work	43%
Improvement of working conditions	50%

The question of the distribution of training is closely related to management's selection of candidates for training. Management's discretionary power around training gets expessed in three related ways: the provision of training without regard to seniority, management favouritism, and limited opportunities for older workers. One out of every three respondents to the CAW Technology Survey reported that training was provided out of line of seniority. The same proportion indicated that older workers were not given equal opportunities.

As with most issues surrounding technological change there is both a 'plus' and a 'minus' side associated with training. On the plus side is the increased corporate emphasis and commitment to training, as well as those few noteworthy initiatives that suggest the possibility of changing established patterns around training. Examples are the GM Truck initiative of involving workers in the preparation, scheduling and teaching of course material, and the efforts at Chrysler to have a group of skilled trade workers involved in scheduling and teaching training courses.

CASE STUDY

- The issue of who is getting the training is a pressing one . . . It seems that training is unevenly distributed between salaried and hourly personnel:

  "For every robot they bought for that front cover area, they had money attached to it for training. They used it all on the engineers . . . Now we've probably had about twelve electricians who have had some training on it, out of about sixty. And we've had less than that number of machine repair. I would say maybe six out of seventy."

  The union's complaint that engineers are getting the lion's share of the technical training is borne out by available data. During the period July-December 1985 the engineers at the plant — who number fewer than fifty — commanded 46% of the technical training hours.

  Engine Plant

- At CanFab production workers who were initially trained on the Gerber consider their training adequate and appropriate. They were trained in plant by a Gerber rep and were given a long period of time to adjust to the equipment. Subsequent operators are trained by existing operators and are not given the same depth or breadth of training. Similarily, two tradesmen were sent to the U.S. to be trained on Gerber maintenance. On their return they were asked, and expected, to train the other tradesmen, but the company refused to provide the time to do so. The training had to be 'catch as catch can', much to the dissatisfaction of those involved.

  CanFab

- "I think there is a kind of coming together, a common ground on training. Hopefully I'm right in what I'm saying. We've had some input into it and so far it's turned out to be positive. But it's been an uphill fight for us in that respect."

  Chrysler Case Study, union rep

On the minus side are all the indications which suggest that management will use training to shape the workplace in ways that unevenly distribute the benefits of new technology while unevenly sharing the costs.

FUTURE DIRECTIONS

New technology can eliminate jobs, displace workers, change skills, redefine jobs and alter social relations. Technological change can dramatically change the organization of work and it can lead to shifts in the distribution of power within the workplace and within the broader society. These changes are yet to be responded to in collective agreements.

New technology can, and probably will increasingly, put strains on existing collective bargaining structures. Technological change can highlight both the strengths and the weaknesses of industrial relations systems. In recognizing these strains management has chosen to promote certain aspects of the Japanese model of labour relations, particularly those features that emphasize the informal, non-legal relationship between management and labour. In response, many workers and union representatives have emphasized the importance of the formal, legal relationship.

- "We have to have black and white language . . . Management would rather have a good rapport with the individual guys on the floor . . . The union has to force the company to recognize in language . . . It has to be forced on them to say we are going to meet, every month, with an agenda . . ."

  Engine Plant Case Study

Workers and local union leaders are concerned with a broad range of impacts of new technology. The responses to the CAW Technology Survey indicate that ranked at the top of the list of concerns that warrant the 'greatest need for union action' are 'job security, protection of the bargaining unit and retraining'. But also on that list are a number of other concerns which are ranked highly: these range from the provision of 'information on new technology' to 'negotiating the hours and schedules of work'.

Union efforts to negotiate the introduction of technology — the defensive and reactive posture of protection, as well as any effort to directly influence the design and implementation of new technology — comes quickly up against the legal prerogatives of management. As one worker expressed it: "That management rights clause. You might as well take the rest of the book and throw it away. Something has to be done about it."

Unlike some jurisdictions, Canada fails to provide a supportive legislative framework for active union participation in technological change. Public policy has

been directed at encouraging and, to varying degrees, underwriting, or at least offsetting, the installation cost of new technology. Governments have treated technology as a central element in the emerging equation of international competitiveness. Rarely has the state acted to mitigate the negative impacts of new technology, let alone empower workers to participate as an equal partner in the process of technological change.

In practice public policy initiatives — even legislation — are only first steps in strengthening workers' rights around the introduction of technology. Eventually the factors that determine the effectiveness of union involvement in technological change are the same factors that determine the outcome of any collective bargaining effort: membership education and support, leadership and sustained action. As it relates to the introduction of new technology, however, success is also contingent on a clear assessment of the effect of technology, an awareness of the possibilities for influencing changes and an exploration of the options implicit in any situation of technological change.

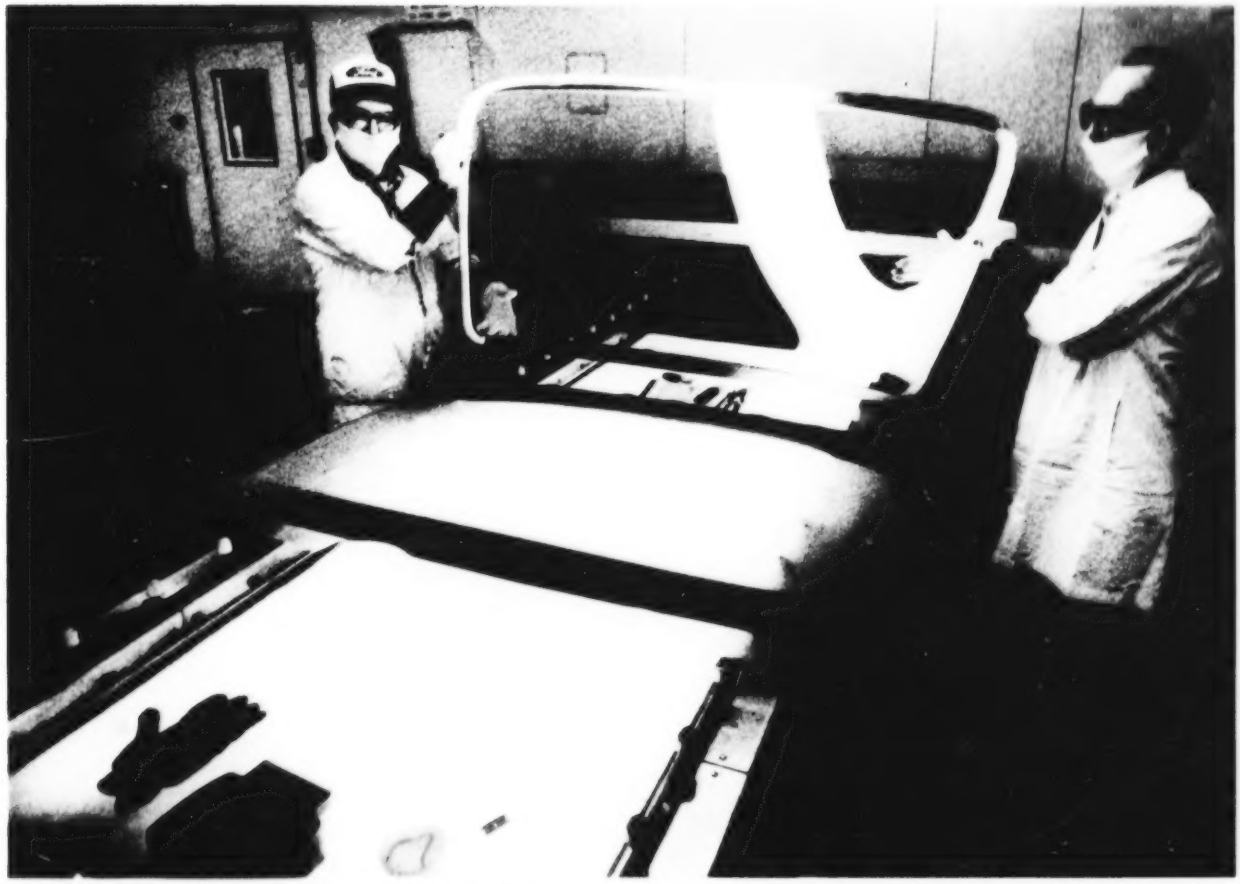
- The European Economic Community has published policy guidelines regarding technological change and employment. In light of these guidelines the EEC has identified a number of areas where member states should take action. In terms of the present discussion two stand out. These are:

Conditions of Work

Increase awareness of the problems raised by new technology in terms of conditions of work, in order to promote specific actions to improve the situations, in terms of job enrichment, prevention and protection against new risks.

Social Partners

The new technology brings changes in the distribution and scale of industrial and social power, as well as substantive upheavels in the lives of many workers. The consequences of such change should be recognized in the trade unions having full access to all necessary information, and the right of consultation on proposals for the implementation of the new technology whether or not there are job losses.



Environmentally controlled heated-windshield line at Ford Glass.

Jim McKenna

LABOUR AND THE PROCESS OF TECHNOLOGICAL CHANGE SUMMARY

- Management uses technology to improve productivity, quality and efficiency, cut costs, reduce labour, deskill work, tighten their control over the pace of work and increase flexibility.
- The role of the union in technological change has been to protect workers from the negative effects while promoting its beneficial impacts.
- The contours of technological change are similar across the industry, but specific results are the product of the interaction of a variety of social and economic forces.
- There are three basic models of management's approach to technological change: the classic autocractic/technocratic approach; the enlightened capitalist/human relations approach; a negotiation model.
- Each approach is distinguished by the degree of union and worker involvement in the process of tech change.
- In auto the process of technological change can be characterized as a hybrid of the autocratic and enlightened capitalist/human relations models.
- A technological change model based on the negotiation model has not yet been developed in auto.
- The outcomes of technological change are shaped, nonetheless, by both formal and informal levels of interaction between the union and management.
- At the formal level the process of technological change is structured by the provisions of collective agreements.
- Less than half the plants who responded to the CAW Technology Survey reported some form of technological change language.
- There is a considerable range in language among those covered, and only half of those with language say they are regularly consulted about the introduction of new tech.
- Consultation on technological changes does occur in the absence of collective agreement language, but the probability of consultation increases if language exists.
- Three issues have, to date, been the focus of collective agreement language on new tech: protection of bargaining unit work; retraining for displaced workers; new technology training for skilled trades.
- While these areas of focus may have been adequate in the past they are no longer sufficient; they must be broadened and language must be expanded into new areas to keep up with the current impacts of technology.
- Training has become a prepequisite of the new technology, but the focus and content of training have been shifted by the requirements of the technology.
- Training now involves the transmission of new analytic, interpersonal and technical skills and encourages worker commitment to, and cooperation with, management.
- Management's new emphasis on training is expressed through significant increases in the time, money and facilities devoted to training.
- New technology training programs are putting more emphasis on basic skills and academic qualifications, analytic and problem solving skills and interpersonal skills and group dynamics.
- Cultural training is becoming a dominant theme in the corporate training initiative.
- Survey respondents ranked training, along with job security and protection of the bargaining unit, as the top three issues for the union with regard to new technology.
- The major areas of conflict between workers and management over training include: the extent of training; the content and appropriateness of training; the uneven distribution of training; and management discretion and control over training.
- Workers argue there just isn't enough training going on.
- Lack of training is often used as an excuse by management to hire outside contractors, to give work to excluded employees and to justify hiring new employees for new technology jobs.
- Workers often comment that the content of training programs is haphazard and inadequate.
- New technology training is unevenly distributed across companies and within companies themselves.
- Management's discretionary power to select the candidates for training gets expressed in three related ways: the provision of training without regard to seniority, management favouritism and limited opportunities for older workers.
- New technology affects all aspects of working life. In this sense it can, and will increasingly, strain existing collective bargaining structures.
- Any attempt by the union to negotiate the broad range of issues associated with technological change comes quickly up against management's resistance and the management's rights clause.
- In addition to collective bargaining, public policy initiatives must be pursued as well.
- To date there has been no legislative framework in Canada to support active union participation in technological change.

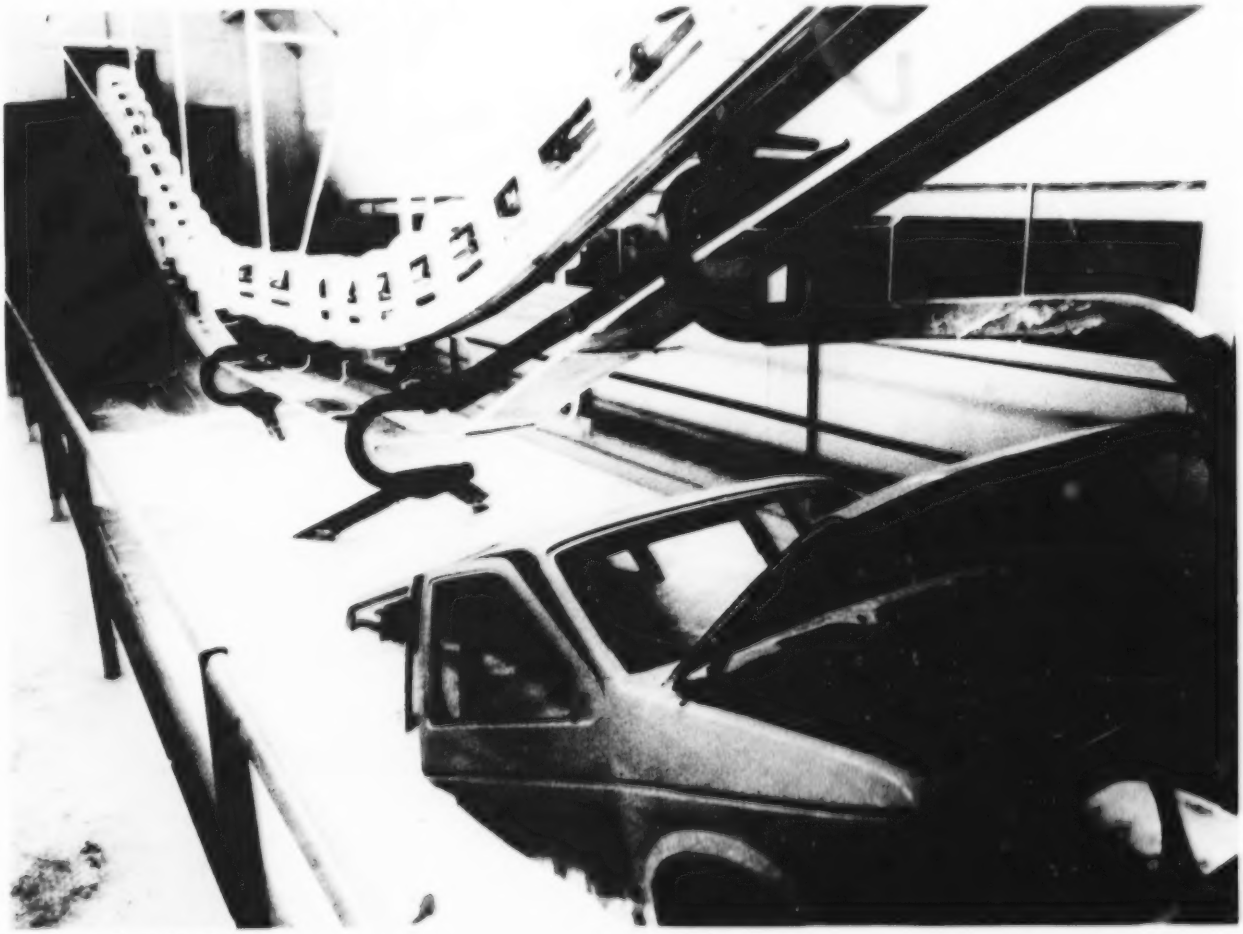
POLICY IMPLICATIONS

Technological change is on the agenda. Corporate enthusiasm for a particular type of technology or a particular constellation of technologies might wane, but the underlying motivation does not. Corporations will continue to reduce costs, improve efficiencies and increase productivity by introducing technology; they will continue to use it as an opportunity to restructure the workplace; they will continue to look for labour relation innovations in quarters that do not have strong union traditions; and they will increasingly whipsaw workers while encouraging their individual support and involvement. Management is currently the dominant actor in labour relations, and technology can be played as a trump card in both economic and ideological terms. Who can retard progress? Who can reject the olive branch of more cooperation? Who can resist the demands of international competitiveness?

In the mid-fifties the Canadian Labour Congress asked in concerned tones: "If traditional mechanization has produced this effect, what will automation do, piled on top of traditional mechanization?" Today the question is more complex: what will technological change do piled on top of outscourcing, overcapacity, rationalisation, greenfield production, and threatening developments in trade? In the fifties the question was at least partially answered by the sixties and a period of economic expansion. Not so the question of the eighties. The auto industry is, at best, in a period of jobless growth and, what is more probable, an era of employment decline. There are few developments on the wider horizon that encourage optimism.

The introduction of new technology provides a focus for union efforts to improve the quality of work life. But the conflicting trends and conflicting effects of new technology make the task more difficult to accomplish. They also make the need to do so more imperative. If the impact of new technology was solely detrimental, the union could respond with strategies to resist technological change or at least offset its negative impacts. If the consequences were always positive the union could embrace technology while working to resolve the inevitable frictions involved with its implementation. Neither of these options are practical. Instead the union has to recognize technology's conflicting potential. It has to be equipped to separate technology design issues from those of implementation, and it must influence both. It has to distinguish technical from social objectives and influence both. And it has to differentiate technological determinism from corporate authority, and it must challenge both.

Although situations of technological change embody



Uniprime undercoating dip tank.

options and require choices, these should not be construed to mean either design neutrality or implementation unpredictability. The driving force behind technological change is corporate, the cost-benefit analysis narrowly economic. If the goal of technological change is short-term profit and a single-minded reduction of labour costs, the outcome will surely be a deterioration in the conditions of working life. And this against a backdrop of shrinking employment opportunities.

As is so often the case, trade unions shoulder a weighty responsibility, first in challenging narrow economic interests, and secondly in promoting a broad social agenda. Technological change is a workplace issue, but it is also one of the most powerful social and economic changes of this decade. As such, the union's response to technological change will influence more than the outcomes in a particular plant, company or even industry.

It is clear which of the impacts associated with technological change the union wants to minimize and which it wants to expand. The evidence from the present research points to the following negative trends:

- technology related job loss and displacement
- high levels of insecurity
- deskilling and downgrading
- work intensification
- increased boredom and stress
- deteriorating working conditions
- increased management control
- more rigid division of labour
- isolation and polarisation
- fractured workplaces and erosion of member support
- impaired labour-management relations

In the other column of the technology ledger, the developments that have resulted in:

- greater employment security
- reskilling and skill upgrading in some jobs
- reduced physical workload and hazards
- improved ergonomics
- reduction of boring and repetitive jobs
- enriched and enlarged jobs
- improvement in working conditions
- better social relations with peers and supervisors
- more control, autonomy and responsibility
- increased worker involvement
- greater job satisfaction and better treatment
- better labour-management relations

For the union to tip the scale from problem to opportunity requires efforts on a number of separate, but related, fronts. In part, it has to be achieved through collective bargaining, in part through legislation conferring certain rights, in part through public policy advances, and all against a background of educational and developmental initiatives within the union. When it comes to technological change there is no "one best way".

A STARTING POINT

In the fifties the labour movement in Canada and the U.S. articulated a set of policies which remain appropriate in current discussions. The issue was "Automation" and the threat was unemployment. At the time, most trade unionists accepted automation, and even supported it, as not only necessary, but desirable. At the same time, Labour argued, its impact made it necessary to develop appropriate public policy responses and safeguards.

In the U.S. the trade union position was expressed by labour leaders (such as Walter Reuther) to the Congressional Hearings that were held on *Automation and Technological Change*. In Canada the Canadian Labour Congress presented the views of Labour to the Royal Commission on Canada's Economic Future in 1956. In a report entitled *Probable Effects of Increasing Mechanization in Industry*, the CLC argued for:

- **Shorter Work Time**

  "We can reduce hours of work. We can increase the number of statutory holidays, and lengthen vacations. We can keep youngsters longer in school and college, and we can retire oldsters earlier."

- **Training and Retraining**

  "we will require training and retraining ... Government or government and management will have to take the responsibility for re-training displaced workers."

- **Income Support and Protection**

  "unions can press for the guaranteed annual wage ... for higher unemployment insurance benefits, and old age security and family allowance payments."

- **Higher Wages**

  "press for higher wages in general ... or management will get more than its share of the fruits of technological progress, and the mass purchasing power on which the whole industrial system depends will suffer."

- **Government Policy**

  "unions must press for the right government monetary, fax, tariff and investment policies."

- **Full Employment**

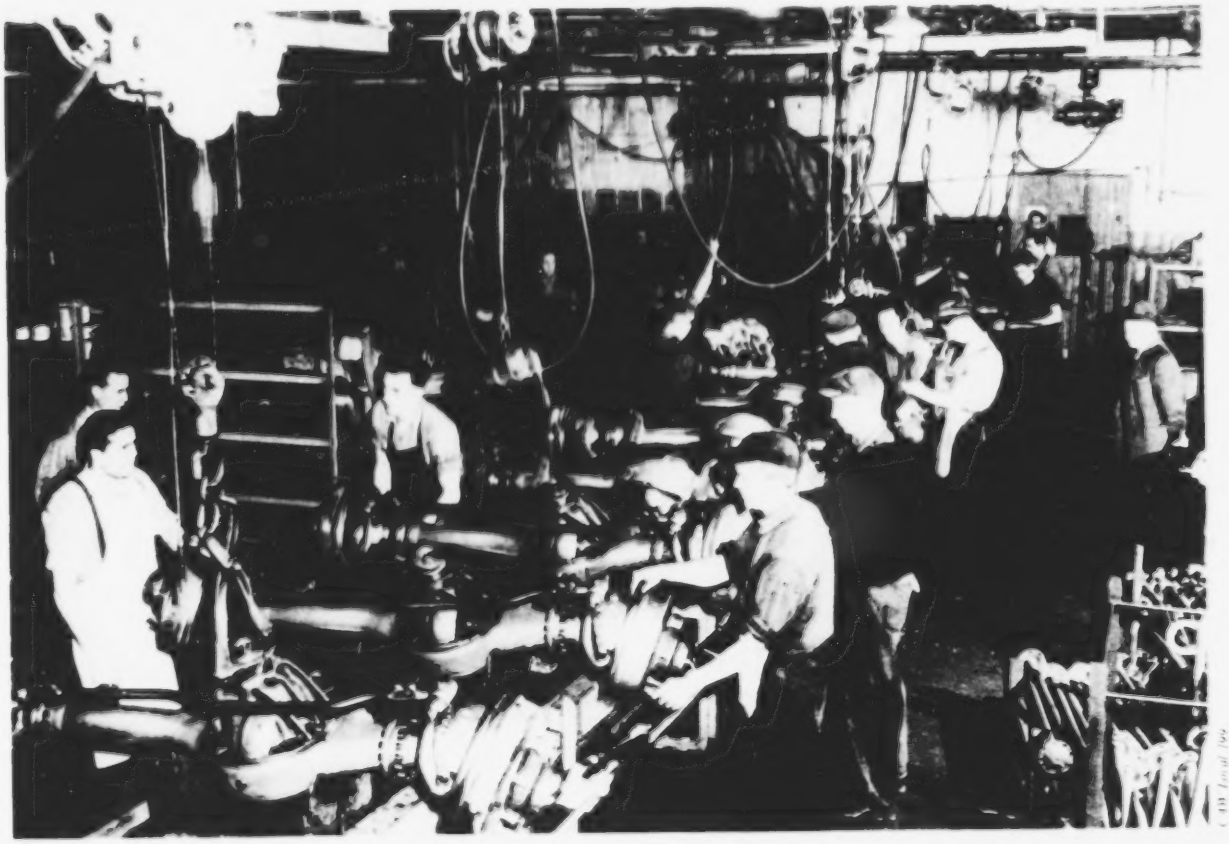
  "we must establish and maintain full employment ... That is by no means all that government has to do, but unless it does this, nothing else it can do will be effective."

While there may be debate on the particulars of any one of these policy proposals, the general thrust remains as relevant a starting point today, in responding to technological change, as it did in the fifties when Labour first confronted automation. But today this isn't enough. As a result of the current project the researchers are convinced that there is a need for a comprehensive strategy on technological change.

A FRAMEWORK FOR A STRATEGY ON TECHNOLOGICAL CHANGE

- **a statement of guiding principles.**
  - recognition of conflicting effects and options.
  - union objectives in technological change.
  - requirement for union involvement at all stages.
  - conditions of union support (i.e. no layoffs).
- **a framework for collective bargaining.**
  - developing a Negotiation model of tech change.
  - Notice - Consultation - Information - Negotiation - Agreement.
  - detailing the requirements at each link in the chain.
- **a program of workplace initiatives.**
  - the union has an active presence on the shop floor.
  - developing that strength on tech change issues.
  - i.e. technology training committees, stewards who specialize in technological change (from ergonomics to job design), active training and education programs for membership.
- **a proposal for legislative reform**
  - enabling legislation conferring rights on unions, setting procedures to be followed, setting standards and, where appropriate, promoting recognized solutions.
  - i.e. a requirement for technology impact assessments when contemplating technological change, a requirement of management to consult and negotiate, limits on the use of equipment for monitoring, worker access to outside experts, etc.
- **a direction for public policy.**
  - specific initiatives regarding technology, such as training/re-training programs, creation of worker support mechanisms, such as technology centres, that would deal with the social and human implications of new technology and would review and promote alternative designs.
  - sectoral-specific policies such as Canadian content requirements in automotive products.
  - broad economic, fiscal and social policies on trade, income support, employment, etc.
- **a set of contract demands.**
  - requires periodic review of the existing technology related provisions of agreements.
  - hard choices on a broad range of issues, from job security to early retirement.
  - as always, a clear assessment of what is possible.

In the automotive sector the introduction of new technology remains both a challenge and a threat. But if the challenge of technology is not met, then its impacts will be measured, not in threats, but in negative outcomes. Technology can benefit us in the long term, but only if it benefits us in the series of short terms that lead us there.



TECHNOLOGY DEFINITIONS

ROBOT Robots come in different sizes, can be either hydraulic or electronic, and are used for a range of operations. But what robots all have in common is that they are flexible automation, which means they can be programmed. Robots have a jointed or moveable arm, and an 'end effector', which can be changed to perform a variety of different tasks.

CNC This acronym stands for Computer Numerical Control. It refers to the new generation of metalworking machines which bore, drill, ream, cut, grind, mill, lathe and otherwise shape metal parts and tools according to instructions programmed on, and transmitted by, a computer.

AMHS Automated Material Handling Systems store and move products and materials under computer control. Some systems are used primarily to shuttle items to work stations or between work stations on automated carts or conveyers. Other systems involve an automated warehouse where parts are stored on racks and retrieved with computerized carts and lift trucks.

CAD/CAM Computer Assisted Design and Manufacturing involves the use of computers to do the design, layout and specification work formerly done by engineers and drafters with pen and ink. The more sophisticated systems integrate design with production functions — once the specifications have been determined at the computer terminal the instructions are transmitted to the programmable machinery in the plant.

AGV Automatic Guided Vehicles have also been referred to as robot carts. They are computer controlled and travel in programmed directions following wires inset in the floor. Some AGVs are used just to shuttle parts, but others are used as platforms which travel from workstation to workstation and on which products are built.

TRANSFER LINE A transfer line is the product of the automation of engine plants in the fifties. A series of metalworking machines (i.e. some that drill, others mill, etc.) are integrated together in one system so that a work piece can be put in at the beginning and come out the other end, after hundreds of separate operations, without human intervention.

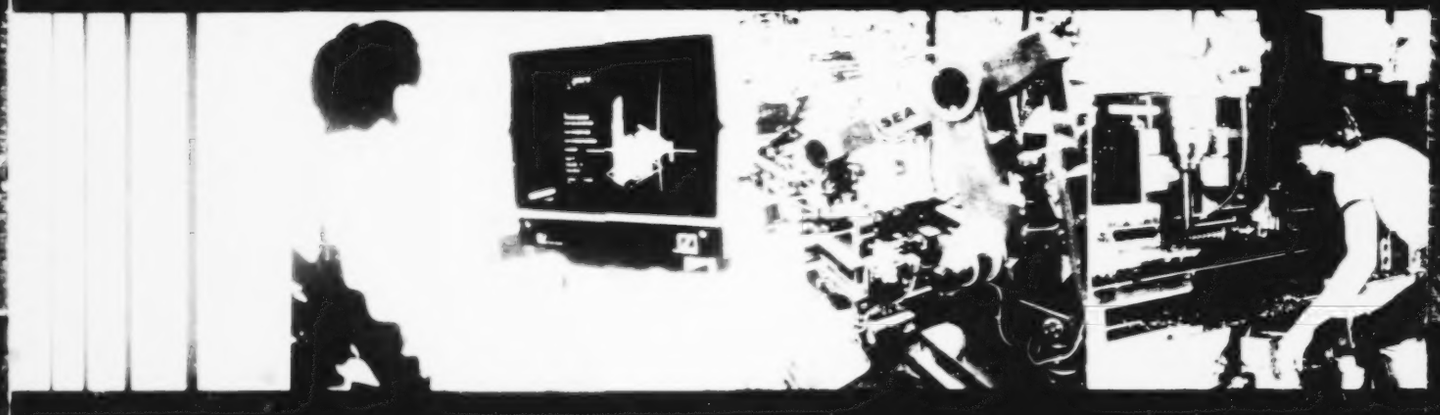
JIT Just-In-Time is a manufacturing system based on minimal levels of inventory and flexible production. Instead of stockpiling material or parts the JIT system is an attempt to ensure delivery of the appropriate material to the right place just as it is needed for production. This includes both in-plant stock and material delivered by suppliers.

SPC Statistical Process Control is the use of statistical techniques to improve product quality by measuring variations in production specifications. The goal of SPC is to reduce scrap and rework costs and guarantee product quality. Since it can be used to track variations it can aid in predicting and troubleshooting quality problem areas. SPC goes hand in hand with JIT.

QTD Quick Tool and Die change techniques are an attempt to reduce the set-up times and changetimes of various production machinery. These techniques can involve the installation and use of specialized equipment or, more commonly, simply changing the order and procedures of a die changeover.

CIM Computer Integrated Manufacturing implies a system-wide application of computer automation. It is a concept of the totally automated factory where all operations — from the office functions of design and financial accounting, ordering and inventory, to the plant functions of material handling, production and shipping — are integrated and controlled by an integrated computer system.

FMS Flexible Manufacturing Systems are a station along the way to CIM. It involves an automated production unit with machines interconnected by transport systems and with the various operations controlled by a computer. The system is also flexible, such that production can vary without retooling the system.



CAW TCA
CANADA

205 Placer Court
North York, Willowdale
Ontario M2H 3H9

(416) 497-4110
Telex 06-986509

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